

DESCRIPTION

CONSTITUTION DETERMINATION DEVICE, QUESTIONNAIRE PRODUCTION METHOD, CONSTITUTION DETERMINATION METHOD, 5 AND RECORDING MEDIUM

Technical Field

[0001] The present invention relates to a constitution determination device, etc.
that determines a user's constitutional type in response to the user answering
10 two or more questions.

Background Art

[0002] Conventionally, in China, users have been classified into one of nine
constitutional types in response to the users answering the Constitution in
15 Chinese Medicine Questionnaire consisting of sixty questions (for example, see
Non-Patent Document 1).

[0003] There has also been a system that is capable of identifying the
constitution and skin condition of a subject (see Patent Document 1). Such a
system is an identification system for identifying at least one of a subject's
20 constitution and skin characteristics, including: a measuring body-suit
configured to be worn by the subject to obtain body shape data of the subject; a
database in which information regarding a constitution and/or information
regarding skin characteristics, for which a correlation coefficient with respect to
the body shape data is greater than a predetermined value, is stored in
25 association with the body shape data; and an identification unit configured to
compare the body shape data of the subject obtained from the measuring body-
suit with accumulated data accumulated in the database, to identify at least one
of a constitution and skin characteristics correlated with the body shape data of
the subject.

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Citation List

Patent Document

[0004]

Patent Document 1: JP 2019-154870A

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Non-Patent Document

[0005] Non-Patent Document 1: “Tyu-i taishitsu gaku ni motozuku kokonotsu no taishitsu shindan & adobaisu (Nine-constitution diagnosis and advice based on traditional Chinese medicine constitution)”, [online], [searched on August 18, 10 2021], Internet [URL: <https://www.bhy.co.jp/lp/>]

Summary of Invention

Technical Problem

[0006] However, with the conventional technology, a person’s constitution 15 cannot be easily determined. In particular, with the conventional technology, a person’s constitution cannot be determined in response to the person simply answering a small number of questions. For example, it takes about ten minutes to answer the Constitution in Chinese Medicine Questionnaire consisting of sixty questions, and it is not easy to determine the constitution.

20 [0007] In addition, with the conventional technology, it is impossible to construct a questionnaire for appropriately determining a person’s constitution. In particular, the determination of one of the nine constitutional types using the Constitution in Chinese Medicine Questionnaire cannot be said to be suitable for determining the constitution of modern Japanese people.

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Solution to Problem

[0008] A constitution determination device according to a first aspect of the present invention is: a constitution determination device that includes: an answer acceptance unit that accepts an answer set that is a set of pieces of 30 answer information respectively corresponding to two or more questions; a

determination unit that determines to which constitutional type the answer set accepted by the answer acceptance unit corresponds from among constitutional types corresponding to two or more classes that are results of performing clustering on two or more answer sets; and a result output unit that outputs a determination result that includes the constitutional type that is a result of the determination by the determination unit.

[0009] With such a configuration, it is possible to easily determine a person's constitution.

[0010] A constitution determination device according to a second aspect of the present invention is the constitution determination device according to the first aspect, wherein the two or more questions are questions that correspond to a contribution level that satisfies a selection condition out of three or more questions.

[0011] With such a configuration, a person's constitution can be easily determined in response to the person simply answering a small number of questions.

[0012] A constitution determination device according to a third aspect of the present invention is the constitution determination device according to the first aspect or the second aspect of the invention, wherein the two or more questions corresponding to the answer set accepted by the answer acceptance unit are a branching question set that is formed using N questions (N is equal to or greater than 3), and the answer acceptance unit accepts an answer set that is a set of pieces of answer information corresponding to different M ($M < N$) questions of the branching question set, using pieces of answer information sequentially input by a user.

[0013] With such a configuration, a person's constitution can be more easily determined in response to the person simply answering a small number of questions.

[0014] A constitution determination device according to a fourth aspect of the present invention is the constitution determination device according to the third

aspect, wherein at least one question of the branching question set appears at two or more nodes included in the branching question set.

[0015] With such a configuration, a person's constitution can be more easily determined in response to the person simply answering a small number of questions.

[0016] A constitution determination device according to a fifth aspect of the present invention is the constitution determination device according to any one of the first to fourth aspects, wherein the number of constitutional types resulting from the clustering is five, and the determination unit determines to which constitutional type the answer set accepted by the answer acceptance unit corresponds from among the five constitutional types.

[0017] With such a configuration, it is possible to easily and appropriately determine the constitutions of Japanese people.

[0018] A constitution determination device according to a sixth aspect of the present invention is the constitution determination device according to any one of the first to fifth aspects, further including: an additional information acquisition unit that acquires additional information that corresponds to the constitutional type that is the result of the determination by the determination unit; and an additional information output unit that outputs the additional information.

[0019] With such a configuration, it is possible to easily determine a person's constitution, and provide additional information.

[0020] A constitution determination device according to a seventh aspect of the present invention is the constitution determination device according to the sixth aspect, wherein the additional information acquisition unit acquires additional information that corresponds to the constitutional type that is the result of the determination by the determination unit and to one or more pieces of answer information included in the answer set.

[0021] With such a configuration, it is possible to easily determine a person's constitution, and provide additional information.

[0022] A constitution determination device according to an eighth aspect of the present invention is the constitution determination device according to any one of the first to seventh aspects, further including: an attribute value acquisition unit that acquires user attribute values that correspond to one or more pieces of answer information included in the answer set; and an attribute value output unit that outputs the user attribute values.

[0023] With such a configuration, it is possible to acquire user attribute values, using answers to questions for determining a person's constitutional type.

[0024] A questionnaire production method according to a ninth aspect of the present invention is a questionnaire production method including: an answer set storage unit that stores respective answer sets of two or more users responding to X questions; a clustering unit that performs clustering on the two or more answer sets to determine constitutional types that are Y classes; a contribution level acquisition unit that acquires a contribution level of each of the X questions for determining the Y constitutional types; a question selection unit that selects N ($N < X$) questions whose contribution levels acquired by the contribution level acquisition unit satisfy a selection condition, from the X questions; and a questionnaire forming unit that forms a questionnaire that includes the N questions selected by the question selection unit.

[0025] With such a configuration, it is possible to acquire a questionnaire for easily determining a person's constitution.

[0026] A questionnaire production method according to a tenth aspect of the present invention is the questionnaire production method according the ninth aspect, wherein the clustering unit determines the constitutional types that are Y classes, for the two or more answer sets, using a non-hierarchical clustering method, and performs hierarchical clustering on the two answer sets, using a hierarchical clustering method, so that lowest level classes are the Y classes, the contribution level acquisition unit acquires a contribution level of each of the X questions, for each branch of each layer of the hierarchically classified classes, the question selection unit selects one or more questions whose contribution

level satisfies a selection condition, for each branch of each layer of the hierarchically classified classes, and the questionnaire forming unit forms a questionnaire that is a branching question set that includes the one or more questions selected by the question selection unit for each branch of each layer of the hierarchically classified classes.

[0027] With such a configuration, it is possible to acquire a questionnaire for more easily determining a person's constitution.

[0028] A questionnaire production method according to an eleventh aspect of the present invention is the questionnaire production method according the tenth aspect, wherein the contribution level acquisition unit uses a random forest algorithm to acquire the contribution level of each of the X questions, for each branch of each layer of the hierarchically classified classes.

[0029] With such a configuration, it is possible to acquire a questionnaire for easily determining a person's constitution.

Advantageous Effects of Invention

[0030] With the constitution determination device according to the present invention, a person's constitution can be easily determined.

Brief Description of Drawings

[0031] FIG. 1 is a block diagram for a questionnaire production device 1 according to a first embodiment.

FIG. 2 is a flowchart illustrating an operation example of the questionnaire production device 1 according to the same.

FIG. 3 is a flowchart illustrating an example of question selection processing according to the same.

FIG. 4 is a flowchart illustrating an example of branch condition acquisition processing according to the same.

FIG. 5 is a flowchart illustrating a second operation example of questionnaire production device 1 according to the same.

FIG. 6 is a graph with the number of classes on the horizontal axis and the gap statistic on the vertical axis according to the same.

FIG. 7 is a table regarding five constitutional types according to the same.

5 FIG. 8 is a diagram showing the validity of the classification into five constitutional types according to the same.

FIG. 9 is a diagram showing an example of a questionnaire that is a set of branching questions according to the same.

10 FIG. 10 is a diagram showing an example of thirty-nine questions according to the same.

FIG. 11 is a diagram illustrating a general idea of the processing according to the same.

FIG. 12 is a conceptual diagram for a constitution determination system B according to a second embodiment.

15 FIG. 13 is a block diagram for the constitution determination system B according to the same.

FIG. 14 is a flowchart illustrating an operation example of a constitution determination device 2 according to the same.

20 FIG. 15 is a flowchart illustrating an operation example of a terminal device 3 according to the same.

FIG. 16 is a diagram showing a questionnaire management table according to the same.

FIG. 17 is a diagram showing an example of a graphically illustrated questionnaire according to the same.

25 FIG. 18 is a diagram showing an example of a set of pieces of question information according to the same.

FIG. 19 is a diagram illustrating a general idea of the flow of the processing according to the same.

30 FIG. 20 is a diagram showing an example of an output according to the same.

FIG. 21 is an overview of a computer system according to the above-described embodiments.

FIG. 22 is a block diagram for the computer system according to the same.

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Description of Embodiments

[0032] Hereinafter, embodiments of a constitution determination device, etc. with reference to the drawings. Note that the constituent elements with the same reference numerals perform the same operations in the embodiment, and therefore redundant descriptions thereof may be omitted.

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First Embodiment

[0033] The present embodiment describes a method for constructing a questionnaire for determining a constitutional type. In particular, how to construct a questionnaire with a tree structure will be described.

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[0034] Note that a constitution is a set of physical characteristics that a person is born with or that results from lifestyle habits. The constitution may also include mental qualities.

[0035] FIG. 1 is a block diagram for a questionnaire production device 1 according to the present embodiment. The questionnaire production device 1 includes a storage unit 11, an acceptance unit 12, a processing unit 13, and an output unit 14. The storage unit 11 includes an answer set storage unit 111. The processing unit 13 includes a clustering unit 131, a contribution level acquisition unit 132, a question selection unit 133, a condition acquisition unit 134, and a questionnaire forming unit 135.

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[0036] The storage unit 11 stores various kinds of information. Examples of the various kinds of information include an answer set, which will be described later.

[0037] The answer set storage unit 111 stores two or more answer sets. The two or more answer sets are typically the respective answer sets of two or more

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different users. Each answer set is a set of pieces of answer information of a user responding to X questions. Note that X is a natural number that is greater than or equal to 3. It is preferable that X is greater than or equal to 60. X is 332, for example. Each piece of answer information is information specifying the answer to a question. Each piece of answer information may also be simply referred to as an answer. Each answer set is a vector whose elements are pieces of answer information respectively corresponding to X questions. The questions are questions that are considered to be useful in determining the constitutional type, and there is no limitation on the contents thereof. Questions may also be referred to as quizzes, inquiries, or the like.

[0038] Each answer set may include one or more user attribute values. User attribute values are pieces of information that specify attributes of a user, which are sex, age, and age group, for example. A piece of answer information, which is a user attribute value, may be regarded as information specifying the answer to a question asking about a user attribute value.

[0039] The acceptance unit 12 accepts various kinds of information and instructions. Examples of the various kinds of information and instructions include an operation start instruction and an answer set. The operation start instruction is an instruction to start processing to form a questionnaire. It is preferable that the operation start instruction includes the number of layers. The number of layers is the depth of layers in a branching question set.

[0040] The “acceptance” here is a concept that includes acceptance of information input from an input device such as a keyboard, a mouse, or a touch panel, reception of information transmitted via a wired or wireless communication network, or acceptance of information read from a recording medium such as an optical disk, a magnetic disk, or a semiconductor memory.

[0041] Any input means, such as a touch panel, a keyboard, a mouse, a menu screen, or the like, may be employed to input the various instructions and information.

[0042] The acceptance unit 12 may receive various kinds of information and

instructions from a terminal (not shown).

[0043] The processing unit 13 performs various kinds of processing. Examples of the various kinds of processing include the processing performed by the clustering unit 131, the processing performed by the contribution level acquisition unit 132, the processing performed by the question selection unit 133, and the processing performed by the questionnaire forming unit 135.

[0044] The clustering unit 131 performs clustering on two or more answer sets stored in the answer set storage unit 111, and determines the constitutional types, which are Y classes. Note that Y is a natural number that is greater than or equal to 2. It is preferable that Y is 5. It is preferable that Y is not 9. The processing performed to determine the constitutional types, which are Y classes, is, for example, processing performed to assign IDs (for example, “1”, “2”, “3”, “4”, and “5”) that respectively identify the classes to the two or more answer sets.

[0045] The clustering unit 131 determines Y constitutional types by performing clustering on two or more answer sets, using the following method (1), (2), or (3).

(1) The case where only a non-hierarchical clustering method is used

[0046] For example, the clustering unit 131 performs clustering on two or more answer sets using a non-hierarchical clustering method, and determines two or more classes (Y classes). For example, the k-means method is preferable as a non-hierarchical clustering method, but other non-hierarchical clustering methods such as the hypervolume method may also be used.

[0047] When the non-hierarchical clustering method is used, it is preferable that the clustering unit 131 sequentially increases the number of classes, for example starting from “1” or “2”, evaluates the clustering result for each number of classes, determines the minimum number of classes whose evaluation result satisfies a condition, and acquires the clustering result for the number of classes. The evaluation result is, for example, a gap statistic. The fact that the evaluation result satisfies the condition is, for example, the fact that the evaluation result (for example, a gap statistic) differs from the highest

evaluation result by a value no greater than a threshold value or a value less than the threshold value, or the fact that, when the number of classes is increased sequentially, the difference between the evaluation result for the current number of classes and the evaluation result for the previous number of classes is no greater than a threshold value or is less than the threshold value. If the condition is that the difference between the evaluation result for the current number of classes and the evaluation result for the previous number of classes is no greater than the threshold value or is less than the threshold value, the clustering unit 131 determines the previous number of classes as the final number of classes, for example.

(2) The case where both a non-hierarchical clustering method and a hierarchical clustering method are used

[0048] For example, the clustering unit 131 performs clustering on two or more answer sets using a non-hierarchical clustering method, and determines two or more classes (Y classes). For example, the clustering unit 131 performs clustering on two or more answer sets using a non-hierarchical clustering method, and determines “five” classes. In a non-hierarchical clustering method, it is preferable that the clustering unit 131 sequentially increases the number of classes as described above, evaluates the clustering result, and, when the evaluation result satisfies a condition, acquires the number of classes corresponding thereto.

[0049] Next, for example, the clustering unit 131 performs hierarchical clustering on two or more answer sets using a hierarchical clustering method so that the lowest classes are Y classes.

[0050] Note that here, the clustering unit 131, for example, performs hierarchical clustering on two or more answer sets using a hierarchical clustering method so that the number of layers is equal to the number of layers given by the user or the number of layers corresponding to the number of layers stored in advance in the storage unit 11, and the lowest classes are Y classes.

Note that the number of layers corresponds, for example, to the number of questions that the user must answer in order to determine the user's constitutional type.

[0051] Here, the clustering unit 131 may use, for example, all of the pieces of answer information that constitutes the answer set used in the non-hierarchical clustering method, or only some of the pieces of answer information whose contribution level satisfies the condition.

[0052] The hierarchical clustering method may be agglomerative hierarchical clustering or divisive hierarchical clustering. For example, the Ward method is suitable as the hierarchical clustering method, but other methods such as the longest distance method, the shortest distance method, and the group average method may also be used.

(3) For example, the clustering unit 131 performs clustering on two or more answer sets using a hierarchical clustering method, and determines two or more classes (Y classes). Here, it is preferable that the clustering unit 131 performs clustering on two or more answer sets using a hierarchical clustering method so that the number of layers is equal to the number of layers given by the user or the number of layers corresponding to the number of layers stored in advance in the storage unit 11, and determines two or more classes (Y classes).

[0053] The contribution level acquisition unit 132 acquires the contribution level of each of X questions for determining Y constitutional types.

[0054] For example, the contribution level acquisition unit 132 acquires the contribution level of each of the X questions for each branch of each layer of the hierarchically classified classes.

[0055] There may be various methods for the contribution level acquisition unit 132 to acquire the contribution level each question, and there is no limitation. Specifically, the contribution level acquisition unit 132 acquires the contribution level of each of the X questions, using the following method (1-1), (1-2), (2-1), or (2-2).

(1) The case where the contribution level is acquired from a random forest learning model

(1-1) The case where only a non-hierarchical clustering method is used to perform clustering

[0056] The contribution level acquisition unit 132 acquires the result of the processing performed by the clustering unit 131, and acquires two or more pieces of training data, which are combinations of an answer set and a type identifier that is a constitutional type identifier associated with the answer set, using the result of the processing. Note that training data is, for example, a vector whose elements are pieces of answer information constituting answer sets, and type identifiers. Each of the answer sets constituting the training data may include one or more user attribute values such as sex.

[0057] Next, the contribution level acquisition unit 132 provides the two or more pieces of training data to a random forest learning module, executes the learning module, and acquires a learning model. Thereafter, using the learning model, the contribution level acquisition unit 132 acquires the contribution level of each of the questions corresponding to the pieces of answer information. Note that the contribution level of each question is information regarding the contribution level of each question (each piece of answer information, each element of the vector that constitutes training data) in acquiring a type identifier, and may also be referred to as a contribution rate or the degree of importance. Note that the processing performed to acquire the contribution level of each of the questions corresponding to the answers, using the learning model acquired by executing a random forest learning module, is a well-known technique.

(1-2) The case where a hierarchical clustering method is used to perform clustering

[0058] The contribution level acquisition unit 132 acquires, for each of the

nodes (branches) that constitute the layers, two or more sets of training data, which are combinations of an answer set and an identifier corresponding to the node. Note that an identifier is information identifying each of two or more branches. Next, for each of the nodes that constitute the layers, the contribution
5 level acquisition unit 132 provides two or more pieces of training data to a random forest learning module, executes the learning module, and acquires a learning model. Thereafter, for each of the nodes that constitute the layers, using the learning model, the contribution level acquisition unit 132 acquires the contribution level of each of the questions corresponding to the pieces of
10 answer information.

(2) The case where the contribution level is acquired using the result of an evaluation of the accuracy of the learning model for machine learning

(2-1) The case where only a non-hierarchical clustering method is used to
15 perform clustering

[0059] The contribution level acquisition unit 132 acquires the result of the processing performed by the clustering unit 131, and acquires two or more pieces of training data, which are combinations of an answer set and a type identifier that is a constitutional type identifier associated with the answer set, using the
20 result of the processing. Next, the contribution level acquisition unit 132 acquires a basic accuracy, which is the accuracy (any accuracy among the accuracy rate, precision rate, recall rate, or the like) of the learning model formed using the answers to all the questions and the type identifiers, using the k-fold cross validation, for example.

25 [0060] Next, the contribution level acquisition unit 132 forms a vector whose elements are, for example, the answers excluding the answer to one question out of all the questions, and type identifiers. Next, the contribution level acquisition unit 132 acquires a missing accuracy, which is the accuracy of the learning model formed using the answers to the questions excluding the answer to one
30 question, and the type identifiers, using the k-fold cross validation, for example.

Next, the contribution level acquisition unit 132 calculates the difference between the basic accuracy and the missing accuracy. Next, for example, the contribution level acquisition unit 132 calculates the contribution level of the question corresponding to the excluded answer, using an increasing function that employs the difference as a parameter. Note that the contribution level of the question corresponding to the excluded answer can be calculated using the arithmetic expression “ $f(\text{basic accuracy} - \text{missing accuracy})$ ”. The greater the difference between the basic accuracy and the missing accuracy, the higher the contribution level of the excluded answer, i.e., the excluded question. Excluding an answer also means excluding the question corresponding to the answer.

[0061] Thereafter, for example, the contribution level acquisition unit 132 changes the question to be excluded, from the first question to the N^{th} question, and acquires N missing accuracies respectively for the excluded questions, using the k -fold cross validation.

[0062] Note that the contribution level acquisition unit 132 uses a machine learning module to perform k -fold cross validation. The machine learning module may be random forest, decision tree, deep learning, SVR, or the like, and there is no limitation on the algorithm thereof. For machine learning, various machine learning functions such as the TensorFlow library, fastText, tinySVM, and the R language random forest module, as well as various existing libraries, can be used. Note that the k -fold cross validation is a well-known technique, and therefore the detailed description thereof will be omitted.

[0063] In the method (2-1), for example, the contribution level acquisition unit 132 may acquire the contribution level of each question by using only the N missing precisions without using the basic precision. That is to say, the contribution level acquisition unit 132 may acquire the contribution level such that the lower the accuracy indicated by the missing accuracy corresponding to the missing question, the higher the contribution level of the question. For example, the contribution level acquisition unit 132 may use a decreasing function that employs the missing accuracy of each question as a parameter, to

acquire the contribution level of each question.

(2-2) The case where a hierarchical clustering method is used to perform clustering

- 5 [0064] The contribution level acquisition unit 132 acquires, for each of the nodes (branches) constituting the layers, two or more sets of training data, which are combinations of an answer set and an identifier corresponding to the node. Next, for example, for each of the nodes (branches) constituting the layers, the contribution level acquisition unit 132 acquires the basic accuracy, which is the
- 10 accuracy of the learning model formed using the answers to the questions and the identifiers, by performing the k-fold cross validation.
- [0065] Next, for example, for each of the nodes (branches) constituting the layers, the contribution level acquisition unit 132 forms a vector whose elements are the answers excluding the answer to one question out of the corresponding
- 15 questions, and identifiers. Next, for example, for each of the nodes (branches) constituting the layers, the contribution level acquisition unit 132 acquires a missing accuracy, which is the accuracy of the learning model formed using the answers to the questions excluding the answer to one question, and the type identifiers, using the k-fold cross validation. Next, for each of the nodes
- 20 (branches) constituting the layers, the contribution level acquisition unit 132 calculates the difference between the basic accuracy and the missing accuracy. Next, for example, for each of the nodes (branches) constituting the layers, the contribution level acquisition unit 132 calculates the contribution level of the question corresponding to the excluded answer, using an increasing function
- 25 that employs the difference as a parameter. Note that the contribution level of the question corresponding to the excluded answer can be calculated using the arithmetic expression “ $f(\text{basic accuracy} - \text{missing accuracy})$ ”. The greater the difference between the basic accuracy and the missing accuracy, the higher the contribution level of the excluded answer, i.e., the excluded question. Excluding
- 30 an answer also means excluding the question corresponding to the answer.

[0066] Thereafter, for example, for each of the nodes (branches) constituting the layers, the contribution level acquisition unit 132 changes the question to be excluded, from the first question to the N^{th} question, and acquires N missing accuracies respectively for the excluded questions, using the k -fold cross validation.

[0067] In the method (2-2), for example, the contribution level acquisition unit 132 may acquire the contribution level of each question by using only the N missing precisions without using the basic precision, for each of the nodes (branches) constituting the layers. That is to say, for each of the nodes (branches) constituting the layers, the contribution level acquisition unit 132 may acquire the contribution level such that the lower the accuracy indicated by the missing accuracy corresponding to the missing question, the higher the contribution level of the question. For example, the contribution level acquisition unit 132 may use a decreasing function that employs the missing accuracy of each question as a parameter, to acquire the contribution level of each question.

[0068] The question selection unit 133 selects N ($N < X$) questions whose contribution levels acquired by the contribution level acquisition unit 132 satisfy a selection condition, from the X questions. Note that the selection condition is, for example, that the contribution level is higher than or equal to a threshold value, that the contribution level is higher than the threshold value, that the contribution level is ranked top N^{th} or higher (N is a natural number), or that the contribution level is ranked higher than the top N^{th} .

[0069] For example, the question selection unit 133 selects one or more questions whose contribution level satisfies the selection condition for each branch of each layer of the hierarchically classified classes. The selection condition is a condition regarding the contribution level of each question. The selection condition is, for example, that the contribution level is the highest.

[0070] The condition acquisition unit 134 acquires a branching condition for the hierarchical structure of the questionnaire that is a branching question set. The

condition acquisition unit 134 acquires a branching condition for each of the nodes that are not the lowest in the hierarchical structure. The branching condition is a condition for determining which of two or more lower nodes to branch to in the questionnaire with the hierarchical structure. The branching
5 condition is a condition for the classification of two or more lower classes corresponding to one node in the questionnaire with the hierarchical structure. The branching condition is a condition for one node, acquired using answer information corresponding to a question selected by the question selection unit 133.

10 [0071] The condition acquisition unit 134 acquires, for each branch of each layer of hierarchically classified classes, two or more pieces of answer information for the question that corresponds to the node corresponding to the branch and that has been selected by the question selection unit 133, from the answer set storage unit 111, and acquires a branching condition that is a
15 condition for belonging to two or more nodes that are one level lower than the node.

[0072] There may be various methods for the condition acquisition unit 134 to acquire the branch condition, and there is no limitation on the method. For example, using two or more pieces of answer information corresponding to the
20 two lower branches (lower nodes) of the node of interest, the condition acquisition unit 134 acquires the representative value (for example, the average value, or the median value) of the pieces of answer information for each of the two lower branches, and, using the average value of the representative values as a threshold value, acquires a branching condition “lower than or equal to the
25 threshold value” or “lower than the threshold value”.

[0073] For example, using the range of values that answer information can take (for example, a natural number from “1” to “5”), the condition acquisition unit 134 creates branching condition candidates in which the median value of two values is varied one by one. Note that such branch condition candidates are, for
30 example, “<1.5”, “<2.5”, “<3.5”, and “<4.5”. Thereafter, the condition acquisition

unit 134 calculates, for each of the branch condition candidates, the classification accuracy of two or more pieces of answer information for each of the two lower branches. That is to say, for example, the condition acquisition unit 134 acquires the accuracy (for example, the correct answer rate, the F value,
5 or the like) when the two or more pieces of answer information for each of the two branches are classified based on the branching condition “<1.5”. Similarly, for example, the condition acquisition unit 134 acquires the accuracies when the two or more pieces of answer information for each of the two branches are classified based on the branching condition “<2.5”, “<3.5”, and “<4.5”. Thereafter,
10 the condition acquisition unit 134 acquires the branching condition with the highest accuracy.

[0074] For example, the condition acquisition unit 134 may acquire a learning model through machine learning processing. That is to say, the condition acquisition unit 134 forms, for each node in each layer of the hierarchically
15 classified classes, two or more pieces of training data having two or more pieces of answer information and branch identifiers corresponding to the node, and forms a learning model by performing machine learning processing on the two or more pieces of training data. Such a learning model is information that is provided to a module for prediction processing together with answer information
20 so that the module can output a branch identifier. Note that machine learning here may be random forest, deep learning, SVM, or the like, and there is no limitation. In addition, in such a case, the branch conditions involve a learning model.

[0075] For example, the condition acquisition unit 134 may form a decision tree using the Gini impurity as an index using an algorithm called CART, and
25 thereafter acquire a branching condition for each node of the decision tree.

[0076] The questionnaire forming unit 135 forms a questionnaire having the N questions selected by the question selection unit 133.

[0077] For example, the questionnaire forming unit 135 forms a questionnaire
30 that is a set of branched questions having one or more questions selected by the

question selection unit 133 for each branch of each layer of the hierarchically classified classes.

[0078] For example, for each node of the layers of the hierarchically classified classes, the questionnaire forming unit 135 forms a questionnaire in which one
5 or more questions selected by the question selection unit 133 and the branching condition acquired by the condition acquisition unit 134 are associated with each other.

[0079] The output unit 14 outputs various kinds of information. Examples of the various kinds of information include a questionnaire, which will be described
10 later.

[0080] Here, “output” is a concept that encompasses displaying on a display screen, projection using a projector, printing by a printer, the output of a sound, transmission to an external device, accumulation on a recording medium, delivery of a processing result to another processing device or another program,
15 and the like.

[0081] It is preferable that the storage unit 11 and the answer set storage unit 111 are realized using a non-volatile recording medium, but they may be realized using a volatile recording medium.

[0082] There is no limitation on the process in which information is stored in
20 the storage unit 11 and so on. For example, information may be stored in the storage unit 11 or the like via a recording medium, or information transmitted via a communication line or the like may be stored in the storage unit 11 or the like, or information input via an input device may be stored in the storage unit 11 or the like.

[0083] The acceptance unit 12 can be realized using a device driver for the input means such as a touch panel or a keyboard, or control software or the like for controlling the menu screen. The acceptance unit 12 may be realized using a wireless or wired communication means.

[0084] The processing unit 13, the clustering unit 131, the contribution level
30 acquisition unit 132, the question selection unit 133, the condition acquisition

unit 134, and the questionnaire forming unit 135 can typically be realized using a processor, a memory, and so on. The processing procedures performed by the processing unit 13 and so on are typically realized using software, and the software is recorded on a recording medium such as a ROM. However, such

5 processing procedures may be realized using hardware (a dedicated circuit). Note that the processor is, for example, a CPU, an MPU, a GPU, or the like, and there is no limitation on the type thereof.

[0085] The output unit 14 may be regarded as including or not including an output device such as a display or a speaker. The output unit 14 can be realized

10 using the driver software of the output device, the driver software of the output device and the output device, or the like. Note that the output unit 41 and so on may be realized using a wireless or wired communication means.

[0086] Next, an operation example of the questionnaire production device 1 will be described with reference to the flowchart in FIG. 2.

15 [0087] (Step S201) The acceptance unit 12 judges whether or not an operation start instruction has been accepted. If an operation start instruction has been accepted, processing proceeds to step S202, and if an operation start instruction has not been accepted, processing returns to step S201.

[0088] (Step S202) The clustering unit 131 acquires two or more answer sets

20 from the answer set storage unit 111.

[0089] (Step S203) The clustering unit 131 performs clustering on the two or more answer sets acquired in step S202, using a non-hierarchical clustering method. It is assumed that as a result of the clustering, the two or more answer sets are classified into Y classes.

25 [0090] (Step S204) The contribution level acquisition unit 132 acquires the contribution level of each of X questions for determining Y constitutional types.

[0091] (step S205) The question selection unit 133 selects three or more questions, using the contribution level of each of the X questions acquired in step S204. An example of such question selection processing will be described with

30 reference to the flowchart in FIG. 3.

[0092] (Step S206) The clustering unit 131 acquires the number of layers included in the operation start instruction accepted in step S201.

[0093] (Step S207) The clustering unit 131 performs hierarchical clustering using the two or more answer sets acquired in step S202, using a hierarchical
5 clustering method, so that the lowest classes are Y classes and the number of layers is the number of layers acquired in step S206.

[0094] In such a case, it is preferable that the clustering unit 131 forms two or more answer sets (vectors) whose elements are only the pieces of answer information corresponding to the three or more questions selected in step S205,
10 and performs hierarchical clustering on the two or more answer sets. However, the clustering unit 131 may perform hierarchical clustering on the two or more answer sets acquired in step S202.

[0095] (Step S208) The contribution level acquisition unit 132 substitutes 1 for a counter i.

15 [0096] (Step S209) The contribution level acquisition unit 132 judges whether or not an i^{th} node is present resulting from the hierarchical clustering in step S207. If the i^{th} node is present, processing proceeds to step S210, and if the i^{th} node is not present, processing proceeds to step S214.

[0097] Here, it is preferable that the contribution level acquisition unit 132
20 processes the nodes of the answer sets subjected to hierarchical clustering, in a breadth-first manner starting from the node at the highest level.

[0098] (Step S210) The contribution level acquisition unit 132 acquires the respective contribution levels of the questions corresponding to the i^{th} node, using the two or more answer sets corresponding to the i^{th} node and the
25 respective identifiers of the branches corresponding to the answer sets.

[0099] (Step S211) The question selection unit 133 selects one or more questions corresponding to the i^{th} node, using the contribution level acquired in step S210. Note that the question selection unit 133 selects one or more questions that satisfy the selection condition. The selection condition is, for
30 example, that the questions have the highest contribution level.

[0100] (Step S212) The condition acquisition unit 134 acquires the branching condition corresponding to the i^{th} node. An example of such branching condition acquisition processing will be described with reference to the flowchart in FIG. 4.

5 [0101] (Step S213) The contribution level acquisition unit 132 increments the counter i by 1. Processing returns to step S209.

[0102] (Step S214) The questionnaire forming unit 135 forms a questionnaire that includes the questions selected by the question selection unit 133 for each node and selected in step S211. Note that the questionnaire here is a branching

10 question set.

[0103] (Step S214) The output unit 14 accumulates the questionnaire formed in step S213. Processing returns to step S201.

[0104] In the flowchart in FIG., it may be.

[0105] In the flowchart in FIG. 2, processing is terminated when power is

15 turned off or an interruption is made to terminate the processing.

[0106] Next, an example of the question selection processing in step S205 will be described with reference to the flowchart in FIG. 3.

[0107] (Step S301) The question selection unit 133 acquires a basic accuracy, which is the accuracy of the clustering, using an answer set that is a set of the

20 pieces of answer information for all the questions.

[0108] (Step S302) The question selection unit 133 substitutes 1 for the counter i .

[0109] (Step S303) The question selection unit 133 acquires two or more pieces of training data by adding, to training data, the answer to the question with the

25 i^{th} contribution level, for each of the two or more answer sets. Note that the training data includes all the pieces of answer information at the i^{th} and lower levels and the identifiers thereof.

[0110] (Step S304) The question selection unit 133 acquires the accuracy when all the pieces of answer information with the at the i^{th} and lower levels, using

30 the two or more pieces of training data acquired in step S303. Note that the

question selection unit 133 acquires the accuracy, using the k-fold cross validation, for example.

[0111] (Step S305) The question selection unit 133 judges whether or not the accuracy acquired in step S304 satisfies the condition. If the condition is satisfied, processing proceeds to step S306, and if the condition is not satisfied, processing proceeds to step S307.

[0112] (Step S306) The question selection unit 133 selects all the questions up to the i^{th} level.

[0113] (Step S307) The question selection unit 133 increments the counter i by 1. Processing returns to step S303.

[0114] Next, an example of the branching condition acquisition processing in step S212 will be described with reference to the flowchart in FIG. 4.

[0115] (Step S401) The condition acquisition unit 134 acquires the question identifiers of the questions selected in step S211.

[0116] (Step S402) The condition acquisition unit 134 substitutes 1 for the counter i .

[0117] (Step S403) The condition acquisition unit 134 judges whether or not a branch from the node of interest to the i^{th} lower level is present. If a branch to the i^{th} lower level is present, processing proceeds to step S404, and otherwise processing proceeds to step S406.

[0118] (Step S404) The condition acquisition unit 134 acquires pieces of answer information corresponding to the question identifiers acquired in step S401, from two or more answer sets corresponding to the branch to the i^{th} lower level. Here, the condition acquisition unit 134 acquires two or more pieces of answer information.

[0119] (Step S405) The condition acquisition unit 134 increments the counter i by 1. Processing returns to step S403.

[0120] (Step S406) The condition acquisition unit 134 acquires a branching condition that employs answer information, using the two or more pieces of answer information corresponding to the two or more branches to the lower level

acquired in step S404. Processing returns to higher-level processing.

[0121] Next, a second operation example of the questionnaire production device 1 will be described with reference to the flowchart in FIG. 5. Note that the flowchart in FIG. 5 is constituted by any of the steps of the flowchart in FIG. 2, and therefore redundant descriptions thereof will be omitted.

Specific Examples

[0122] Hereinafter, a specific operation example of the questionnaire production device 1 according to the present embodiment will be described. The Constitution in Chinese Medicine Questionnaire can classify constitutions into nine constitutional types, but the optimal number of constitutions for modern Japanese people is unknown. Therefore, in order to acquire a questionnaire using the questionnaire production device 1, the following steps were taken.

[0123] First, 332 questions were prepared regarding the Constitution of Chinese Medicine Questionnaire (CCMQ-J), the Food Frequency Questionnaire (FFQg Ver.5), basic background (sex, height, weight, date of birth, etc.), exercise habits, sleep (the Pittsburgh Sleep Quality Index), health condition, medical history, personality (TIPI-J), depression (K6), stress (the Stress Check, Ministry of Health, Labor and Welfare), cognitive function (MMSE), appetite (SNQA Japanese version), and so on. Such questions can be said to be questions that can be used to determine a person's constitutional type.

[0124] A set of answers to the above 332 questions were obtained from 851 subjects living in different parts of Japan.

[0125] Next, the respective answer sets of the 851 subjects were vectorized and accumulated in the answer set storage unit 111 of the questionnaire production device 1. The vectors of the answer sets include sexes.

[0126] Next, in order to form a questionnaire for determining a user's constitutional type in response to the user simply answering to about 4 to 5 questions, which can be called a simple questionnaire, it is assumed that the inventor input an operation start instruction including "<the number of layers>5"

to the questionnaire production device 1. Accordingly, the acceptance unit 12 of the questionnaire production device 1 accepts such an operation start instruction.

[0127] Next, the clustering unit 131 of the questionnaire production device 1 performed clustering on the 851 vectors in the answer set storage unit 111, using the k-means method. As a result, the clustering unit 131 classified the 851 vectors into five classes.

[0128] More specifically, the clustering unit 131 set the number of classes to each of 1 to 9, and performed clustering on the 851 vectors in the answer set storage unit 111, using the k-means method. The gap statistic was calculated for each number of classes. FIG. 6 is a graph where the horizontal axis represents such a number of classes (Number of groups) and the vertical axis represents the gap statistic (Optimal number of groups). The clustering unit 131 acquired the number of classes “5” with which the gap statistic satisfies the condition (for example, the difference from the maximum value is within a threshold value) as the number of constitutional types of Japanese people. The number of classes “5” indicates that the Gap function is stable.

[0129] That is to say, the clustering unit 131 may perform clustering on the plurality of vectors in the answer set storage unit 111 for each of the two or more numbers of classes in a given range, evaluate the results, determine the number of classes for which the evaluation result satisfies the condition, and acquire the clustering result corresponding to the number of classes. It is preferable that the number of classes that satisfies the condition is the smallest number of classes. Although the gap statistic was used to evaluate the clustering results, other methods may be used.

[0130] The inventor summarized five constitutional types as shown in FIG. 7 from the answer sets to the 332 questions. Note that the terms “Qi-depression type”, “Yang-deficiency type”, and “Gentleness type” in FIG. 7 represent constitutional types included in the nine constitutional types determined using the Constitution in Chinese Medicine Questionnaire in China. The term “9

constitutions” in FIG. 7 represents the nine constitutions determined using the Constitution in Chinese Medicine Questionnaire in China. In FIG. 7, there are five records each having “Type identifier”, “Characteristics” and “Constitution”. The “type identifier” is an ID that identifies a constitutional type. The “Characteristics” is information that expresses the characteristics of the constitutional type. The “Constitution” is information that simply expresses the constitutional type.

[0131] It was found that when the vectors of the answer sets of 851 Japanese subjects were forcibly classified into the nine classes, the answer sets (vectors) of the nine classes were mixed and could not be correctly classified, as shown in FIG. 8(a). On the other hand, it was found that when the vectors of the answer sets of 851 Japanese subjects were forcibly classified into the five classes, the answer sets (vectors) of the five classes were clearly separated and could be correctly classified, as shown in FIG. 8(b). That is to say, it was shown that the appropriate number of constitutional types for Japanese people is “5”. Note that in FIGS. 8(a) and (b), the horizontal axis “PC1” is the first principal component axis, and the vertical axis “PC2” is the second principal component axis.

[0132] Note that the characteristics of the five constitutions obtained in this experiment are directly related to the issues facing Japanese people today (for example, the number of patients with mental illness is on the rise, 70% of women are sensitive to cold, etc.), and are considered to be symptoms that should be considered in maintaining health.

[0133] Next, the contribution level acquisition unit 132 acquires the contribution level of each of the 332 questions for determining the five constitutional types. Here, the contribution level acquisition unit 132 forms a random forest learning model through, for example, the above-described processing, and acquires the contribution level of each of the 332 questions from the learning model.

[0134] Thereafter, the question selection unit 133 selected top 39 questions in terms of the contribution level from the 332 questions through the operations

described with reference to the flowchart in FIG. 3.

[0135] Next, using the number of classes “5” acquired by the clustering unit 131 and the number of layers “5” included in the operation start instruction, hierarchical clustering was performed on the vectors of the 332 answer sets, using a hierarchical clustering method (the Ward’s method in this example), so that five layers are formed and the lowest classes are five classes.

[0136] Next, the question selection unit 133 selected the top 18 questions in terms of the contribution level, from the top 39 questions. Although the processing by the question selection unit 133 may be omitted here, it is desirable that the constitution can be ultimately determined with about 20 questions, and therefore the top 18 questions were selected.

[0137] Next, for the vectors of the answer sets classified into layers by the clustering unit 131, the contribution level acquisition unit 132 acquired the respective contribution levels of the top 18 questions for each node in the layers.

[0138] Next, the question selection unit 133 selected the question with the highest contribution level for each node in the layers, and associated the selected question to the node.

[0139] The condition acquisition unit 134 acquired a branching condition for transitioning to the left side of the binary tree for each node in the layers, using the method described above.

[0140] Next, the questionnaire forming unit 135 formed a questionnaire having a tree structure including the questions selected for each node by the question selection unit 133 and branching conditions. Note that such a questionnaire is a branching question set.

[0141] Next, the output unit 14 outputs the formed questionnaire in the storage unit 11.

[0142] Through the above-described processing, the questionnaire in FIG. 9 was accumulated. In FIG. 9, the question identifiers such as Q12 (901 in FIG. 9) and Q5 correspond to “ID” in FIG. 10. Note that FIG. 10 is an example of the top 39 questions selected during the processing. Each node in FIG. 9 has a

branching condition (for example, “<1.5” (902 in FIG. 9)), and the questionnaire includes branching conditions. That is to say, in FIG. 9, “<1.5” (902) indicates that if the user’s answer to the question Q12 is “lower than 1.5”, the processing proceeds to the “True” branch, and then the question Q5 is presented to the user.

5 It is also shown that if the user’s answer to the question Q12 is “higher than or equal to 1.5”, the processing proceeds to the “False” branch, and the question 17 is presented to the user. The case where the answer to the question Q12 is “lower than 1.5” is the case where one of “2”, “3”, and “4” is selected (see FIG. 11).

[0143] As described above, with the present embodiment, it is possible to
10 acquire a questionnaire for easily determining a person's constitution. With the present embodiment, in particular, it is possible to acquire a questionnaire for easily and appropriately determining the constitution of Japanese people.

[0144] Furthermore, the processing in the present embodiment may be realized using software. This software may be distributed through software downloading
15 or the like. Also, this software may be recorded on a recording medium such as a CD-ROM and distributed. Note that the same applies to the other embodiments in the present description. The software that realizes the questionnaire production device 1 according to the present embodiment is the program described below. That is to say, this program is a program that enables
20 a computer that can access an answer set storage unit that stores respective answer sets of two or more users responding to X questions to function as: a clustering unit that performs clustering on the two or more answer sets to determine constitutional types that are Y classes; a contribution level acquisition unit that acquires a contribution level of each of the X questions for
25 determining the Y constitutional types; a question selection unit that selects N (N < X) questions whose contribution levels acquired by the contribution level acquisition unit satisfy a selection condition, from the X questions; and a questionnaire forming unit that forms a questionnaire that includes the N questions selected by the question selection unit.

30

Second Embodiment

[0145] The present embodiment describes a constitution determination device that performs clustering on answer sets to the two or more questions included in a questionnaire, and determines the constitutional type of a user from among
5 the constitutional types corresponding to the determined two or more groups.

The constitution determination device can accept answers to two or more questions, and determine the constitutional type corresponding to the answers.

[0146] Note that the present embodiment describes a constitution determination device that determines the constitutional type of a user,
10 particularly by using the questionnaire described in the first embodiment, for example. That is to say, the questionnaire is a branching question set, for example. The number of constitutional types is “5”, for example.

[0147] The present embodiment also describes a constitution determination device that outputs additional information (for example, health risks, health
15 solutions) according to the determined constitutional type.

[0148] The present embodiment also describes a constitution determination device that outputs additional information, using both the determined constitutional type and the accepted answer information.

[0149] Furthermore, the present embodiment describes a constitution determination device that has the function of predicting and outputting user
20 attribute values (for example, BMI), using the answers to two or more questions.

[0150] FIG. 12 is a conceptual diagram for a constitution determination system B according to the present embodiment. The constitution determination system B includes a constitution determination device 2 and one or more terminal
25 devices 3. The constitution determination device 2 is a device that determines a constitutional type. For example, the constitution determination device 2 is a server, but may also be a stand-alone device. The constitution determination device 2 is, for example, a cloud server or an ASP server, but there is no limitation on the type thereof. Each terminal device 3 is a device used by a user,
30 and is, for example, a smart phone, a tablet terminal, a personal computer, or

the like, but there is not limitation on the type thereof.

[0151] FIG. 13 is a block diagram for the constitution determination system B according to the present embodiment. The constitution determination device 2 includes a storage unit 21, an acceptance unit 22, a processing unit 23, and an output unit 24. The storage unit 21 includes a questionnaire storage unit 211, an additional information storage unit 212, and an original information storage unit 213. Note that the questionnaire storage unit 211, the additional information storage unit 212, and the original information storage unit 213 may be included an external device (not shown).

[0152] The acceptance unit 22 includes an answer acceptance unit 221. The processing unit 23 includes a determination unit 231, an additional information acquisition unit 232, and an attribute value acquisition unit 233. The output unit 24 includes a question output unit 241, a result output unit 242, an additional information output unit 243, and an attribute value output unit 244.

[0153] Each terminal device 3 includes a terminal storage unit 31, a terminal acceptance unit 32, a terminal processing unit 33, a terminal transmission unit 34, a terminal reception unit 35, and a terminal output unit 36.

[0154] The storage unit 21 included in the constitution determination device 2 stores various kinds of information. Examples of the various kinds of information include additional information, which will be described later, and user attribute values, which will be described later.

[0155] The questionnaire storage unit 211 stores a questionnaire. It is preferable that this questionnaire is a questionnaire acquired by the questionnaire production device 1. It is preferable that the questionnaire is a branching question set. That is to say, the questionnaire has a hierarchical structure with two or more layers, for example. The hierarchical structure is preferably a binary tree structure, but may be a structure in which at least some nodes have three or more branches. Each node of the questionnaire having a hierarchical structure is associated with one or more pieces of question information. Being associated with question information may also mean having

question information. It is preferable that each node of the questionnaire corresponds to one piece of question information. Furthermore, it is preferable that each node of the questionnaire having a hierarchical structure is associated with a branching condition. The branching condition is a condition for
5 transitioning from one node to a lower level node in the hierarchical structure. The branching condition is a condition for answer information corresponding to one or more pieces of question information. The branching condition is, for example, “answer information for question information corresponding to a node is greater than or equal to a threshold value”, “answer information is less than
10 or equal to a threshold value”, “answer information is greater than a threshold value”, or “answer information is less than a threshold value”. The branching condition may be a condition that uses two or more pieces of answer information.

[0156] The additional information storage unit 212 stores two or more pieces of additional information. It is preferable that the additional information is
15 associated with a constitutional type. The additional information may be associated with a condition that uses a constitutional type. The additional information may be associated with a condition that uses one or more pieces of answer information. Being associated with a condition that uses one or more pieces of answer information may be being associated with a constitutional type,
20 or being associated with a condition that uses a constitutional type. The additional information may be associated with a condition that uses a constitutional type and one or more pieces of answer information.

[0157] The original information storage unit 213 stores one or more pieces of original information. The original information is information used to acquire a
25 user attribute value. The original information is, for example, information that associates an attribute value condition and a user attribute value with each other. The information that associates an attribute value condition and a user attribute value with each other is, for example, information that has an attribute value condition and a user attribute value. An attribute value condition is a
30 condition for determining a user attribute value. The attribute value condition

is, for example, a condition that uses one or more pieces of answer information, a condition that uses a constitutional type, or a condition that uses a constitutional type and one or more pieces of answer information. The original information is, for example, an arithmetic expression that uses a constitutional
5 type as a parameter, and is an arithmetic expression that outputs a user attribute value. Examples of user attribute values include BMI, age, and age group.

[0158] The acceptance unit 22 accepts various kinds of information and instructions. Examples of the various kinds of information and instructions
10 include a start instruction, answer information, and an answer set. The start instruction is an instruction to start the determination of a constitutional type.

[0159] The “acceptance” here typically means reception from the terminal devices 3, but may be a concept that includes acceptance of information input from an input device such as a keyboard, a mouse, or a touch panel, or
15 acceptance of information read from a recording medium such as an optical disk, a magnetic disk, or a semiconductor memory.

[0160] The answer acceptance unit 221 accepts an answer set, which is a set of pieces of answer information respectively corresponding to two or more questions.

[0161] It is preferable that the answer acceptance unit 221 accepts an answer set, which is a set of pieces of answer information corresponding to different M ($M < N$) questions of a branching question set, using pieces of answer information sequentially input by the user. It is preferable that the answer acceptance unit 221 sequentially accepts M pieces of answer information to be
25 ultimately accepted.

[0162] It is preferable that the two or more questions are questions that correspond to a contribution level that satisfies a selection condition out of three or more questions. That is to say, it is preferable that the two or more questions are questions selected by the questionnaire production device 1.

[0163] The processing unit 23 performs various kinds of processing. Examples
30

of the various kinds of processing include the processing performed by the determination unit 231, the processing performed by the additional information acquisition unit 232, and the processing performed by the attribute value acquisition unit 233.

5 [0164] The determination unit 231 determines to which constitutional type the answer set accepted by the answer acceptance unit 221 corresponds, from among the constitutional types corresponding to two or more classes that are the results of performing clustering on two or more answer sets. Note that the constitutional types corresponding to the two or more classes that are the results
10 of performing clustering on two or more answer sets are typically the constitutional types determined by the questionnaire production device 1. It is preferable that the number of constitutional types here is “5”.

[0165] The answer sets accepted by the answer acceptance unit 221 are typically answer sets different from the two or more answer sets used by the
15 questionnaire production device 1 to determine the constitutional types.

[0166] It is preferable that the determination unit 231 determines which of the five constitutional types the user’s constitutional type corresponds to, using the answer sets accepted by the answer acceptance unit 221.

[0167] It is preferable that the determination unit 231 performs processing to
20 determine the next piece of question information for the piece of answer information corresponding to the pieces of question information that are sequentially presented. That is to say, it is preferable that the determination unit 231 performs processing to determine the piece of question information to be presented to user of the branching question set each time.

25 [0168] The additional information acquisition unit 232 acquires one or more pieces of additional information corresponding to the one or more pieces of answer information that have been accepted. Additional information is information that is not a type identifier, and is, for example, information that indicates health risks or information that indicates health solutions. Additional
30 information is, for example, a string, a still image, a moving image, audio, or a

combination thereof, but there is no limitation on the data structure or data type thereof.

[0169] The additional information acquisition unit 232 acquires, for example, additional information corresponding to the constitutional type, which is the
5 result of the determination by the determination unit 231.

[0170] The additional information acquisition unit 232 acquires, for example, additional information that corresponds to the constitutional type, which is the result of the determination by the determination unit 231, and to one or more pieces of answer information included in the answer set.

10 [0171] For example, the additional information acquisition unit 232 references the additional information storage unit 212, and acquires one or more pieces of additional information associated with the condition satisfied by the constitutional type, which is the result of the determination by the determination unit 231.

15 [0172] For example, the additional information acquisition unit 232 references the additional information storage unit 212, and acquires one or more pieces of additional information associated with the condition satisfied by the one or more pieces of answer information that have been accepted.

[0173] For example, the additional information acquisition unit 232 references
20 the additional information storage unit 212, and acquires one or more pieces of additional information that is associated with the condition that is satisfied by the constitutional type, which is the result of the determination by the determination unit 231, and by the one or more pieces of answer information that have been accepted.

25 [0174] The attribute value acquisition unit 233 acquires user attribute values that correspond to one or more pieces of answer information included in the answer set.

[0175] For example, the attribute value acquisition unit 233 uses the original information stored in the original information storage unit 213 to acquire user
30 attribute values that correspond to one or more pieces of answer information

included in the answer set.

[0176] For example, the attribute value acquisition unit 233 acquires one or more user attribute values that correspond to the attribute value condition satisfied by the one or more pieces of answer information that have been
5 accepted, using the original information stored in the original information storage unit 213.

[0177] For example, the attribute value acquisition unit 233 acquires one or more user attribute values that correspond to the attribute value condition satisfied by the constitutional type, which is the result of the determination by
10 the determination unit 231, using the original information stored in the original information storage unit 213.

[0178] For example, the attribute value acquisition unit 233 acquires one or more user attribute values that correspond to the attribute value condition satisfied by the constitutional type, which is the result of the determination by
15 the determination unit 231, and by the one or more pieces of answer information that have been accepted, using the original information stored in the original information storage unit 213.

[0179] The output unit 24 outputs various kinds of information. Examples of the various kinds of information include a questionnaire, question information
20 that is included in the questionnaire, additional information, and user attribute values.

[0180] Here, “output” is typically transmission to the terminal devices 3, but may be a concept that encompasses displaying on a display screen, projection using a projector, printing by a printer, the output of a sound, accumulation on
25 a recording medium, delivery of a processing result to another processing device or another program, and the like.

[0181] The question output unit 241 outputs one or more pieces of question information that are included in the questionnaire in the questionnaire storage unit 211. It is preferable that the question output unit 241 sequentially outputs
30 two or more pieces of question information. It is preferable that the question

output unit 241 outputs question information that is common to all the users and that is the highest level question information included in the questionnaire that has a hierarchical structure. It is also preferable that the question output unit 241 acquires the next question information determined by the
5 determination unit 231 from the questionnaire storage unit 211 according to the user's answer information corresponding to the previous question, and outputs the next question information.

[0182] It is preferable that, for example, the question output unit 241 sequentially outputs four or five different combinations of pieces of question
10 information of eighteen question sets, in response to the user's answer information.

[0183] The result output unit 242 outputs a determination result that includes the constitutional type that is the result of the determination by the determination unit 231. Note that the constitutional type here is a type
15 identifier.

[0184] The additional information output unit 243 outputs the one or more pieces of additional information acquired by the additional information acquisition unit 232.

[0185] The attribute value output unit 244 outputs the one or more user
20 attribute values acquired by the attribute value acquisition unit 233.

[0186] The terminal storage unit 31 included in each terminal device 3 stores various kinds of information. Examples of the various kinds of information include answer information.

[0187] The terminal acceptance unit 32 accepts various kinds of instructions
25 and information. Examples of the various kinds of instructions and information include a start instruction and answer information. The start instruction is an instruction to start constitution determination.

[0188] The terminal processing unit 33 performs various kinds of processing. For example, the various kinds of processing are performed to convert the
30 instruction or information accepted by the terminal acceptance unit 32 into an

instruction or information that has a structure to be transmitted. For example, the various kinds of processing are performed to convert the information received by the terminal reception unit 35 into information that has a structure to be output.

5 [0189] The terminal transmission unit 34 transmits various kinds of instructions and information to the constitution determination device 2. Examples of the various kinds of instructions and information include a start instruction and answer information.

[0190] The terminal reception unit 35 receives various kinds of information.
10 Examples of the various kinds of information include question information, the type identifier of a constitutional type, additional information, and user attribute values.

[0191] The terminal output unit 36 outputs various kinds of information. Examples of the various kinds of information include question information, the
15 type identifier of a constitutional type, additional information, and user attribute values.

[0192] It is preferable that the storage unit 21, the questionnaire storage unit 211, the additional information storage unit 212, the original information storage unit 213, and the terminal storage unit 31 are realized using a non-
20 volatile recording medium, but they may be realized using a volatile recording medium.

[0193] There is no limitation on the process in which information is stored in the storage unit 21 and so on. For example, information may be stored in the storage unit 21 or the like via a recording medium, or information transmitted
25 via a communication line or the like may be stored in the storage unit 21 or the like, or information input via an input device may be stored in the storage unit 21 or the like.

[0194] The acceptance unit 22, the answer acceptance unit 221, and the terminal reception unit 35 are typically realized using a wireless or wired
30 communication means, but may be realized using a broadcast reception means.

[0195] The processing unit 23, the determination unit 231, the additional information acquisition unit 232, the attribute value acquisition unit 233, and the terminal processing unit 33 can typically be realized using a processor, a memory, or the like. The processing procedures performed by the processing unit 23 and so on are typically realized using software, and the software is recorded on a recording medium such as a ROM. However, such processing procedures may be realized using hardware (a dedicated circuit). Note that the processor is, for example, an MPU, a CPU, a GPU, or the like, and there is no limitation on the type thereof.

[0196] The output unit 24, the question output unit 241, the result output unit 242, the additional information output unit 243, the attribute value output unit 244, and the terminal transmission unit 34 are typically realized using a wireless or wired communication means, but may be realized using a broadcast means.

[0197] The terminal acceptance unit 32 can be realized using a device driver for the input means such as a numeric keypad or a keyboard, or control software or the like for controlling the menu screen.

[0198] The terminal output unit 36 may be regarded as including or not including an output device such as a display or a speaker. The terminal output unit 36 can be realized using the driver software of the output device, the driver software of the output device and the output device, or the like.

[0199] Next, an operation example of the constitution determination system B will be described. First, an operation example of the constitution determination device 2 will be described with reference to the flowchart in FIG. 14.

[0200] (Step S1401) The acceptance unit 22 judges whether or not an operation start instruction has been accepted. If an operation start instruction has been accepted, processing proceeds to step S1402, and if an operation start instruction has not been accepted, processing returns to step S1401. Note that such acceptance is, for example, reception from the terminal devices 3.

[0201] (Step S1402) The question output unit 241 acquires the highest level

question information from the questionnaire in the questionnaire storage unit 211.

[0202] (Step S1403) The question output unit 241 outputs the question information acquired in step S1402. Note that such output is, for example,
5 transmission to the terminal devices 3.

[0203] (Step S1404) The answer acceptance unit 221 judges whether or not answer information corresponding to the output question information has been accepted. If answer information has been accepted, processing proceeds to step S1405, and if answer information has not been accepted, processing returns to
10 step S1404.

[0204] (Step S1405) The determination unit 231 acquires a branching condition paired with the question information corresponding to the answer information from the questionnaire storage unit 211.

[0205] (Step S1406) The determination unit 231 determines the branching
15 destination node by applying the answer information accepted in step S1404 to the branching condition acquired in step S1405.

[0206] (Step S1407) The determination unit 231 references the questionnaire storage unit 211 and judges whether or not any type identifier is associated with the branching destination node acquired in step S1406. If type identifiers are
20 associated, the processing proceeds to step S1408, and if no type identifier is associated, processing proceeds to step S1412. Note that the case in which type identifiers are associated is the case in which type identifiers can be acquired.

[0207] (Step S1408) The determination unit 231 acquires the type identifier associated with the branching destination node acquired in step S1406.

[0208] (Step S1409) The additional information acquisition unit 232 references
25 the additional information storage unit 212, and acquires one or more pieces of additional information, using the one or more pieces of answer information that have been accepted, and one or more types of information of the type identifiers acquired in step S1408.

[0209] (Step S1410) The attribute value acquisition unit 233 references the
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original information storage unit 213, and acquires one or more user attribute values, using the one or more pieces of answer information that have been accepted and the one or more types of information of the type identifiers acquired in step S1408.

5 [0210] (Step S1411) The output unit 24 outputs information that includes the type identifiers acquired in step S1408. Processing returns to step S1401. Note that the information that includes type identifiers may also include one or more types of information of one or more pieces of additional information and one or more user attribute values, or only type identifiers.

10 [0211] (Step S1412) The determination unit 231 references the questionnaire storage unit 211, and determines the question information corresponding to the branching destination node acquired in step S1406. Next, the question output unit 241 acquires such question information from the questionnaire storage unit 211.

15 [0212] (Step S1413) The question output unit 241 outputs the question information acquired in step S1412. Processing returns to step S1401. Note that such output is, for example, transmission to the terminal devices 3.

[0213] Note that in the flowchart in FIG. 14, the processing in steps S1409 and S1410 may be omitted.

20 [0214] In the flowchart in FIG. 14, processing is terminated when power is turned off or an interruption is made to terminate the processing.

[0215] Next, an operation example of each terminal device 3 will be described with reference to the flowchart in FIG. 15.

[0216] (Step S1501) The terminal acceptance unit 32 judges whether or not the
25 input of an operation start instruction has been accepted. If the input of an operation start instruction has been accepted, processing proceeds to step S1502, and if the input of an operation start instruction has not been accepted, processing returns to step S1501.

[0217] (Step S1502) The terminal processing unit 33 forms a start instruction
30 to be transmitted. The terminal transmission unit 34 transmits the start

instruction to the constitution determination device 2. Note that the start instruction may include one or more user attribute values.

[0218] (Step S1503) The terminal reception unit 35 judges whether or not question information has been received. If question information has been received, processing proceeds to step S1504, and if question information has not
5 been received, processing returns to step S1503.

[0219] (Step S1504) The terminal processing unit 33 forms a question to be output, using the received question information. The terminal output unit 36 outputs the question.

10 [0220] (Step S1505) The terminal acceptance unit 32 judges whether or not an answer to the question output in step S1504 has been accepted. If an answer has been accepted, processing proceeds to step S1506, and if an answer has not been accepted, processing returns to step S1505.

[0221] (Step S1506) The terminal processing unit 33 forms answer information
15 to be transmitted, using the answer accepted in step S1504. The terminal transmission unit 34 transmits the answer information to the constitution determination device 2.

[0222] (Step S1507) The terminal reception unit 35 judges whether or not a type identifier or the like has been received in response to the transmission of
20 the answer information in step S1506. If a type identifier or the like has been received, processing proceeds to step S1509, and if a type identifier or the like has not been received, processing proceeds to step S1508.

[0223] (Step S1508) The terminal reception unit 35 judges whether or not question information has been received in response to the transmission of the
25 answer information in step S1506. If question information has been received, processing returns to step S1504, and if question information has not been received, processing returns to step S1507.

[0224] (Step S1509) The terminal processing unit 33 forms a type identifier and so on to be output, using the received type identifier and so on. The terminal
30 output unit 36 outputs the type identifier and so on. Processing returns to step

S1501.

[0225] In the flowchart in FIG. 15, processing is terminated when power is turned off or an interruption is made to terminate the processing.

[0226] Hereinafter, a specific operation example of the constitution determination system B according to the Embodiment will be described.

[0227] Now, a questionnaire management table shown in FIG. 16 is stored in the questionnaire storage unit 211 of the constitution determination device 2. The questionnaire management table contains a large number of records each having “ID”, “question identifier”, “branching condition”, “child identifier (T)”, and “child identifier (F)”. Each record is information regarding a node included in the questionnaire that is a branching question set. The “ID” is a node identifier. “1” in the “ID” indicates the highest level node in the hierarchical structure. IDs other than “1” have a structure “layer depth - identifier at the same depth”. That is to say, ID “2-1” indicates the first node in the second layer.

The “question identifier” is an ID of the question information set in FIG. 9, or a condition using a user attribute value. The condition using a user attribute value is a condition using “sex” here, but it may be a condition using another user attribute value (for example, age, etc.). The “branching condition” is a condition for branching to a lower level node or a type identifier. The condition for branching to a lower level node is a conditions for answer information or user attribute values, and a condition for returning either true (True[T]) or false (False[F]). That is to say, the questionnaire with a hierarchical structure here has a binary tree structure. The “child identifier (T)” is the identifier of the lower level node or the type identifier of the constitutional type to be determined when the result of the determination based on the branching condition is true “T”. The “child identifier (F)” is the identifier of the lower level node or the type identifier of the constitutional type to be determined when the result of the determination based on the branching condition is false “F”. Note that the questionnaire management table may be considered as a questionnaire. In addition, in FIG. 16, there is an attribute value NULL(-), but it is interpreted that the

constitutional type corresponding to the attribute value NULL(-) is the same as that corresponding to the “child identifier (T)”.

[0228] A questionnaire graphically illustrating the questionnaire management table in FIG. 16 is shown in FIG. 17. Each node in FIG. 17 is assigned an ID.

5 In addition, the “question identifier” and the “branching condition” in FIG. 16 are written in each node in FIG. 17.

[0229] It is assumed that the questionnaire storage unit 211 stores the question information set shown in FIG. 18. The set in FIG. 18 contains “question identifier”, “question information”, and “answer items”. The “answer items”

10 indicates a set of pieces of answer information that can be selected by the user in response to the question. The information in the “question information” and the “answer items” may be considered as question information.

[0230] In such a situation, it is assumed that the user inputs a start instruction to the terminal device 3. As a result, through the above-described operation, a type identifier that identifies the constitutional type is output from the terminal device 3 as described below.

15 [0231] That is to say, first, the terminal device 3 that has accepted the start instruction transmits the start instruction to the constitution determination device 2.

20 [0232] Next, the constitution determination device 2 receives the start instruction. Thereafter, the determination unit 231 acquires the question identifier “Q12” with “ID = 1” from the questionnaire management table in FIG. 16. Next, the question output unit 241 acquires the question information “Have you ever felt hopeless in the past month?” corresponding to the question identifier “Q12” (1901 in FIG. 19). Next, the question output unit 241 transmits the question information to the terminal device 3.

25 [0233] Next, the terminal device 3 receives the question information and outputs the question. It is assumed that the user inputs the answer information “2: Sometimes”, for example. Next, the terminal device 3 transmits the answer information “2” to the constitution determination device 2.

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[0234] Next, the answer acceptance unit 221 of the constitution determination device 2 receives the answer information “2”. Next, the determination unit 231 acquires the branching condition “<1.5” paired with the question information “Q12” corresponding to the answer information “2” from the questionnaire management table (FIG. 16). Next, the determination unit 231 applies the answer information “2” to the branching condition “<1.5” and acquires “False”, and acquires the ID “2-2” of the branching destination node, from the questionnaire management table (FIG. 16).

[0235] Next, the determination unit 231 references the questionnaire management table (FIG. 16), and acquires the question identifier “Q17” corresponding to the acquired branching destination node “2-2”. Next, the question output unit 241 acquires the question information “Have you felt hypersensitive in the past month?” corresponding to the question identifier “Q17” (1902 in FIG. 19). Next, the question output unit 241 transmits the question information to the terminal device 3.

[0236] Next, the terminal device 3 receives the question information and outputs the question. It is assumed that the user inputs the answer information “1: Rarely”, for example. Next, the terminal device 3 transmits the answer information “1” to the constitution determination device 2.

[0237] Next, the answer acceptance unit 221 of the constitution determination device 2 receives the answer information “1”. Next, the determination unit 231 acquires the branching condition “<3.5” paired with the question information “Q17” corresponding to the answer information “1” from the questionnaire management table (FIG. 16). Next, the determination unit 231 applies the answer information “1” to the branching condition “<3.5” and acquires “True”, and acquires the ID “3-3” of the branching destination node, from the questionnaire management table (FIG. 16).

[0238] Next, the determination unit 231 references the questionnaire management table (FIG. 16), and acquires the question identifier “Q2” corresponding to the acquired branching destination node “3-3”. Next, the

question output unit 241 acquires the question information “Are you easily frightened and anxious?” corresponding to the question identifier “Q2” (1903 in FIG. 19). Next, the question output unit 241 transmits the question information to the terminal device 3.

5 [0239] Next, the terminal device 3 receives the question information and outputs the question. It is assumed that the user inputs the answer information “4: Often”, for example. Next, the terminal device 3 transmits the answer information “4” to the constitution determination device 2.

[0240] Next, the answer acceptance unit 221 of the constitution determination
10 device 2 receives the answer information “4”. Next, the determination unit 231 acquires the branching condition “<3.5” paired with the question information “Q2” corresponding to the answer information “4” from the questionnaire management table (FIG. 16). Next, the determination unit 231 applies the answer information “4” to the branching condition “<3.5” and acquires “False”,
15 and acquires the ID “4-6” of the branching destination node, from the questionnaire management table (FIG. 16).

[0241] Next, the determination unit 231 references the questionnaire management table (FIG. 16), and acquires the question identifier “Q16” corresponding to the acquired branching destination node “4-6”. Next, the
20 question output unit 241 acquires the question information “Have you ever had trouble staying focused in the past month?” corresponding to the question identifier “Q16” (1904 in FIG. 19). Next, the question output unit 241 transmits the question information to the terminal device 3.

[0242] Next, the terminal device 3 receives the question information and
25 outputs the question. It is assumed that the user inputs the answer information “3: Often”, for example. Next, the terminal device 3 transmits the answer information “3” to the constitution determination device 2.

[0243] Next, the answer acceptance unit 221 of the constitution determination device 2 receives the answer information “3”. Next, the determination unit 231
30 acquires the branching condition “<2.5” paired with the question information

“Q16” corresponding to the answer information “3” from the questionnaire management table (FIG. 16). Next, the determination unit 231 applies the answer information “3” to the branching condition “<2.5” and acquires “False”, and acquires the type identifier “Constitution 2” corresponding to the branching destination child identifier (F) from the questionnaire management table (FIG. 16).

[0244] Next, the determination unit 231 acquires “<Feature>Often Yang-deficiency type<Constitution>Cold sensitive type” corresponding to “Constitution 2” from the table in FIG. 7.

[0245] It is assumed that the additional information acquisition unit 232 references the additional information storage unit 212, and acquires the risk information (for example, “susceptible to visceral diseases due to your sensitive to cold ...”) and the solution information (for example, “Aim to walk 8,000 steps a day ...”) corresponding to the constitution 2. It is assumed that the additional information storage unit 212 stores pieces of health risk information and pieces of health solution information in pairs with the five type identifiers.

[0246] It is assumed that the attribute value acquisition unit 233 references the original information storage unit 213 and acquires the BMI (for example, “28.0”) corresponding to the constitution 2. It is assumed that the original information storage unit 213 stores a BMI range or a BMI representative value (average value) in pairs with the five type identifiers.

[0247] Next, the output unit 24 transmits the type identifier “Constitution 2”, the information “<Feature>Often Yang-deficiency type<Constitution>Cold sensitive type” corresponding to “Constitution 2”, the risk information, the solution information, and the BMI to the terminal device 3.

[0248] Next, the terminal reception unit 35 of the terminal device 3 receives the type identifier and so on. Thereafter, the terminal output unit 36 outputs the type identifier and so on. An example of such an output is shown in FIG. 20.

[0249] As described above, according to the present embodiment, a person's constitution can be easily determined because the person need only answer a

small number of simple questions.

[0250] In addition, according to the present embodiment, the constitutional type is one of five types, and the constitutional type of Japanese people can be easily and appropriately determined.

5 [0251] Note that in the present embodiment, the constitution determination device 2 may operate stand-alone. That is to say, the program that realizes the constitution determination device 2 may be, for example, an application or the like that operates in a user's terminal device.

[0252] Furthermore, the processing in the present embodiment may be realized
10 using software. This software may be distributed through software downloading or the like. Also, this software may be recorded on a recording medium such as a CD-ROM and distributed. Note that the same applies to the other embodiments in the present description. The software that realizes the constitution determination device 2 according to the present embodiment is the
15 program described below. That is to say, this program is a program that enables a computer to function as: an answer acceptance unit that accepts an answer set that is a set of pieces of answer information respectively corresponding to two or more questions; a determination unit that determines to which constitutional type the answer set accepted by the answer acceptance unit corresponds from
20 among constitutional types corresponding to two or more classes that are results of performing clustering on two or more answer sets; and a result output unit that outputs a determination result that includes the constitutional type that is a result of the determination by the determination unit.

[0253] FIG. 21 shows an external appearance of a computer that executes the
25 program described herein to realize the constitution determination device 2 and so on according to the various embodiments described above. The above-described embodiments can be realized using computer hardware and a computer program that runs thereon. FIG. 21 is an overview diagram for this computer system 300, and FIG. 22 is a block diagram for the system 300.

30 [0254] In FIG. 21, the computer system 300 includes a computer 301 that

includes a CD-ROM drive, a keyboard 302, a mouse 303, and a monitor 304.

[0255] In FIG. 22, the computer 301 includes, in addition to the CD-ROM drive 3012, an MPU 3013, a bus 3014 that is connected to the CD-ROM drive 3012 and so on, a ROM 3015 for storing programs such as a boot-up program, a RAM 3016 that is connected to the MPU 3013 and is used to temporarily store application program instructions and provide a temporary storage space, and a hard disk 3017 for storing application programs, system programs, and data. Here, although not shown in the drawings, the computer 301 may further include a network card that provides connection to a LAN.

[0256] The program that enables the computer system 300 to perform the functions of the constitution determination device 2 and so on according to the above-described embodiments may be stored in the CD-ROM 3101, inserted into the CD-ROM drive 3012, and furthermore transferred to the hard disk 3017. Alternatively, the program may be transmitted to the computer 301 via a network (not shown) and stored on the hard disk 3017. The program is loaded into the RAM 3016 when the program is to be executed. The program may be directly loaded from the CD-ROM 3101 or the network.

[0257] The program does not necessarily have to include an operating system (OS), a third-party program, or the like that enables the computer 301 to perform the functions of the constitution determination device 2 and so on according to the above-described embodiments. The program need only contain the part of the instruction that calls an appropriate function (module) in a controlled manner to achieve a desired result. How the computer system 300 works is well known and the detailed descriptions thereof will be omitted.

[0258] In the above-described program, the step of transmitting information, the step of receiving information and so on do not include processing performed by hardware, for example, processing performed by a modem or an interface card in the step of transmitting (processing that can only be performed by hardware).

[0259] There may be a single or multiple computers executing the above-described program. That is to say, centralized processing or distributed

processing may be performed.

[0260] Also, as a matter of course, in each of the above-described embodiments, two or more communication means that are present in one device may be physically realized using one medium.

5 [0261] In each of the above-described embodiments, each kind of processing may be realized as centralized processing that is performed by a single device, or distributed processing that is performed by multiple devices.

[0262] As a matter of course, the present invention is not limited to the above-described embodiments, and various changes are possible, and such variations
10 are also included within the scope of the present invention.

Industrial Applicability

[0263] As described above, the constitution determination device according to the present invention achieves the effect of making it easier to determine a
15 person's constitution, and is useful as a constitution determination device and so on.

CLAIMS

1. A constitution determination device comprising:
 - an answer acceptance unit that accepts an answer set that is a set of
 - 5 pieces of answer information respectively corresponding to two or more questions;
 - a determination unit that determines to which constitutional type the answer set accepted by the answer acceptance unit corresponds from among constitutional types corresponding to two or more classes that are results of
 - 10 performing clustering on two or more answer sets; and
 - a result output unit that outputs a determination result that includes the constitutional type that is a result of the determination by the determination unit.
- 15 2. The constitution determination device according to claim 1,
 - wherein the two or more questions are questions that correspond to a contribution level that satisfies a selection condition out of three or more questions.
- 20 3. The constitution determination device according to claim 1 or 2,
 - wherein the two or more questions corresponding to the answer set accepted by the answer acceptance unit are a branching question set that is formed using N questions (N is equal to or greater than 3), and
 - the answer acceptance unit accepts an answer set that is a set of pieces
 - 25 of answer information corresponding to different M ($M < N$) questions of the branching question set, using pieces of answer information sequentially input by a user.
4. The constitution determination device according to claim 3,
- 30 wherein at least one question of the branching question set appears at

two or more nodes included in the branching question set.

5. The constitution determination device according to claim 1,
wherein the number of constitutional types resulting from the clustering

5 is five, and

the determination unit determines to which constitutional type the
answer set accepted by the answer acceptance unit corresponds from among the
five constitutional types.

10 6. The constitution determination device according to claim 1, further
comprising:

an additional information acquisition unit that acquires additional
information that corresponds to the constitutional type that is the result of the
determination by the determination unit; and

15 an additional information output unit that outputs the additional
information.

7. The constitution determination device according to claim 6,
wherein the additional information acquisition unit acquires additional
20 information that corresponds to the constitutional type that is the result of the
determination by the determination unit and to one or more pieces of answer
information included in the answer set.

8. The constitution determination device according to claim 1, further
25 comprising:

an attribute value acquisition unit that acquires user attribute values
that correspond to one or more pieces of answer information included in the
answer set; and

an attribute value output unit that outputs the user attribute values.

30

9. A questionnaire production method comprising:
an answer set storage unit that stores respective answer sets of two or more users responding to X questions;
a clustering unit that performs clustering on the two or more answer
5 sets to determine constitutional types that are Y classes;
a contribution level acquisition unit that acquires a contribution level of each of the X questions for determining the Y constitutional types;
a question selection unit that selects N ($N < X$) questions whose contribution levels acquired by the contribution level acquisition unit satisfy a
10 selection condition, from the X questions; and
a questionnaire forming unit that forms a questionnaire that includes the N questions selected by the question selection unit.
10. The questionnaire production method according to claim 9,
15 wherein the clustering unit
determines the constitutional types that are Y classes, for the two or more answer sets, using a non-hierarchical clustering method, and
performs hierarchical clustering on the two answer sets, using
a hierarchical clustering method, so that lowest level classes are the Y classes,
20 the contribution level acquisition unit acquires a contribution level of each of the X questions, for each branch of each layer of the hierarchically classified classes,
the question selection unit selects one or more questions whose contribution level satisfies a selection condition, for each branch of each layer of
25 the hierarchically classified classes, and
the questionnaire forming unit forms a questionnaire that is a branching question set that includes the one or more questions selected by the question selection unit for each branch of each layer of the hierarchically classified classes.

11. The questionnaire production method according to claim 10,
wherein the contribution level acquisition unit uses a random forest
algorithm to acquire the contribution level of each of the X questions, for each
branch of each layer of the hierarchically classified classes.

5

12. A recording medium having recorded thereon a program that enables a
computer to function as:

an answer acceptance unit that accepts an answer set that is a set of
pieces of answer information respectively corresponding to two or more
10 questions;

a determination unit that determines to which constitutional type the
answer set accepted by the answer acceptance unit corresponds from among
constitutional types corresponding to two or more classes that are results of
performing clustering on two or more answer sets; and

15 a result output unit that outputs a determination result that includes
the constitutional type that is a result of the determination by the determination
unit.