Claims

[Claim 1]

A delivery plan system comprising:

a division unit that divides a delivery problem indicated by initial conditions into delivery problems having a smaller size in a delivery problem in which a delivery object is delivered to a delivery base having a demand; and

a delivery plan generation unit that generates a delivery plan for the delivery problems obtained by the division performed by the division unit,

wherein the division unit associates one demand point included in a delivery base group having a demand for the delivery object and one supply point included in a delivery base group serving as a supply source of the delivery object with each other so that a time of movement from the one demand point to the one supply point is minimized, generates a set of combinations of the demand point and the supply point associated with each other, and divides the delivery problem indicated by the initial conditions into delivery problems from a demand point group to a supply point group which are included in the generated set.

[Claim 2]

The delivery plan system according to claim 1,

wherein the division unit calculates a delivery route from a supply point to a demand point in which a time of movement from one supply point to one demand point is set to be equal to or less than a predetermined value among correspondence relationships between a plurality of supply points and a plurality of demand points which are included in the generated set, and

the delivery plan generation unit generates a delivery plan for the small-scale delivery problem by using a delivery route in which a time of movement is set to be equal to or less than the predetermined threshold value among the delivery routes from the supply point group to the demand point group which are included in the generated set.

[Claim 3]

A delivery plan system comprising:

a division unit that divides a delivery problem indicated by initial conditions into delivery problems having a smaller size in a delivery problem in which a delivery object is delivered to a delivery base having a demand; and

a delivery plan generation unit that generates a delivery plan for the delivery problems obtained by the division performed by the division unit,

wherein the division unit acquires a plurality of pieces of unit route information indicating a preset delivery route including departing from a departure base, performing delivery related to some delivery bases, and returning to the departure base and costs when delivery is performed through the delivery route, calculates a combination in which the number of delivery bases included in a combination, among the combinations of the plurality of pieces of unit route information, is equal to or less than a predetermined number and the sum of costs is minimized, generates a set of a departure

base and a delivery base which are included in the combination, and divides the delivery problem indicated by the initial conditions into delivery problems from a demand point group to a supply point group which are included in the generated set of the departure base and the delivery base.

[Claim 4]

The delivery plan system according to claim 3,

wherein the division unit calculates a combination of the pieces of unit route information by a column generation technique.

[Claim 5]

A delivery plan system comprising:

a division unit that divides a delivery problem indicated by initial conditions into delivery problems having a smaller size in a delivery problem in which a delivery object is delivered to a delivery base having a demand; and

a delivery plan generation unit that generates a delivery plan for the delivery problems obtained by the division performed by the division unit,

wherein the division unit divides a delivery time limit of the delivery object into a plurality of times to divide the delivery problem indicated by the initial conditions into delivery problems for respective times obtained by the division, and

the delivery plan generation unit generates a delivery plan in which the delivery object is delivered to a base having as many demands as possible within each time after the division from a delivery situation of the delivery object at a first time of the times after the division.

[Claim 6]

The delivery plan system according to claim 5,

wherein with regard to a delivery problem related to a last time obtained by the division performed by the division unit, the delivery plan generation unit generates a delivery plan in which the delivery object is delivered to all delivery bases having a demand which is indicated by the initial conditions until the last time ends.

[Claim 7]

A delivery plan system comprising:

a division unit that divides a delivery problem indicated by initial conditions into delivery problems having a smaller size in a delivery problem in which a delivery object is delivered to a delivery base having a demand; and

a delivery plan generation unit that generates a delivery plan for the delivery problems obtained by the division performed by the division unit,

wherein the division unit divides the delivery problem indicated by the initial conditions into delivery problems in which a first delivery time limit shorter than a delivery time limit included in the initial conditions by a predetermined time is set as a new delivery time limit, and

the delivery plan generation unit generates a delivery plan in which the delivery object is delivered to a base having as many demands as possible within the first delivery time limit.

[Claim 8]

The delivery plan system according to claim 7,

wherein the division unit sets a time having a predetermined length and subsequent to the first delivery time limit as a second delivery time limit, and

the delivery plan generation unit generates a delivery plan in which the delivery object is delivered to a base having as many demands as possible within the second delivery time limit.

[Claim 9]

The delivery plan system according to claim 7 or 8,

wherein the delivery plan generation unit generates a delivery plan for terminating delivery of delivery objects of which delivery has not been completed as a result of execution of the delivery plan within a last time when a point in time of completion in a case where the generated delivery plan is executed is set as a start time and a time when the delivery time limit included in the initial conditions elapses from the start time of the first delivery time limit is set as a termination time.

[Claim 10]

The delivery plan system according to any one of claims 5 to 9,

wherein in generating a delivery plan in which the delivery object is delivered to a base having as many demands as possible, the delivery plan generation unit generates a delivery plan on a condition that a delivery staff member and delivery means required for execution of the delivery plan are not left in the delivery base as a result of the execution of the delivery plan.

[Claim 11]

The delivery plan system according to any one of claims 1 to 10,

wherein the delivery plan generation unit solves an integer programming problem based on a time space network model constituted by point information and branch information to generate at least one set of pieces of branch information related to the delivery in the delivery problem after the division performed by the division unit, the point information having a set of a delivery subject delivering the delivery object, a departure base and the delivery base indicating an initial position of delivery means moving the delivery object or the delivery subject, and times based the start time of delivery, and the branch information indicating flow rates of the delivery object, the delivery subject, and the delivery means related to the delivery between two pieces of point information related to the delivery of the delivery object among the pieces of point information.

[Claim 12]

The delivery plan system according to claims 11,

wherein the delivery plan generation unit is configured to generate point information regarding

an entrance having a set of an entrance and a time of the delivery base, point information regarding an exit having a set of an exit and a time of the delivery base, and point information regarding a place for the delivery object having a set of a time and each delivery object related to the delivery base with respect to one delivery base in the time space network model, and set values of flow rates of the delivery subject and the delivery object between the point information regarding the entrance and the point information regarding the delivery object and between the point information regarding the exit and the point information regarding the delivery object to 0 or 1.

[Claim 13]

A delivery plan method comprising:

causing a delivery plan system a step to divide a delivery problem indicated by initial conditions into delivery problems having a smaller size in a delivery problem in which a delivery object is delivered to a delivery base having a demand, and a step to generate a delivery plan for the delivery problems obtained by the division,

wherein the step to divide associates one demand point included in a delivery base group having a demand for the delivery object and one supply point included in a delivery base group serving as a supply source of the delivery object with each other so that a time of movement from the one demand point to the one supply point is minimized, generates a set of combinations of the demand point and the supply point associated with each other, and divides the delivery problem indicated by the initial conditions into delivery problems from a demand point group to a supply point group which are included in the generated set.

[Claim 14]

A program causing a computer of a delivery plan system to function as:

means for dividing a delivery problem indicated by initial conditions into delivery problems having a smaller size in a delivery problem in which a delivery object is delivered to a delivery base having a demand; and

means for generating a delivery plan for the delivery problems obtained by the division.

wherein the means for dividing associates one demand point included in a delivery base group having a demand for the delivery object and one supply point included in a delivery base group serving as a supply source of the delivery object with each other so that a time of movement from the one demand point to the one supply point is minimized, generates a set of combinations of the demand point and the supply point associated with each other, and divides the delivery problem indicated by the initial conditions into delivery problems from a demand point group to a supply point group which are included in the generated set.