What Is Claimed Is:

1. A storage device, comprising:

a non-volatile memory comprising a plurality of sub-blocks that are independently erasable; and

a storage controller comprising a processor configured to control a garbage collection operation on the plurality of sub-blocks, based on a block size of the plurality of sub-blocks,

wherein the plurality of sub-blocks comprises:

a plurality of first sub-blocks, each first sub-block of the plurality of first sub-blocks being coupled to a first word line group and having a first block size, the first word line group comprising a plurality of first word lines stacked in a vertical direction; and

a plurality of second sub-blocks, each second sub-block of the plurality of second sub-blocks being coupled to a second word line group and having a second block size, the second block size being different from the first block size, the second word line group comprising a plurality of second word lines stacked in the vertical direction, and

wherein the processor is further configured to:

select a victim sub-block with a lowest ratio of a valid page count to an invalid page count from among the plurality of sub-blocks; and

copy a valid page of the victim sub-block to a target sub-block from among the plurality of sub-blocks,

wherein both the victim sub-block and the target sub-block are selected from the plurality of first sub-blocks or the plurality of second sub-blocks and have a same block size.

2. The storage device of claim 1, wherein:

the first block size corresponds to a number of first word lines comprised by the plurality of first word lines, and

the second block size corresponds to a number of second word lines comprised by the plurality of second word lines.

3. The storage device of claim 1, wherein:

the first block size corresponds to a first total number of pages comprised by each first sub-block of the plurality of first sub-blocks, and

the second block size corresponds to a second total number of pages comprised by each second sub-block of the plurality of second sub-blocks.

4. The storage device of any one of claims 1 to 3, wherein:

the plurality of sub-blocks respectively correspond to a plurality of memory stacks,

each memory stack of the plurality of memory stacks extends in the vertical direction on a substrate,

the plurality of first sub-blocks respectively correspond to first memory stacks of the plurality of memory stacks arranged on the substrate, and

the plurality of second sub-blocks respectively correspond to second memory stacks of the plurality of memory stacks arranged on the first memory stacks.

5. The storage device of any one of claims 1 to 4, wherein the processor is further configured to:

calculate, for each sub-block of the plurality of sub-blocks, a difference value between the invalid page count and the valid page count; and

select, as the victim sub-block, a sub-block having a largest difference value from among the plurality of sub-blocks.

6. The storage device of any one of claims 1 to 4, wherein the processor is further configured to:

calculate, for each sub-block of the plurality of sub-blocks, a ratio value of the valid page count to the invalid page count; and

select, as the victim sub-block, a sub-block with a smallest ratio value from among the plurality of sub-blocks.

7. The storage device of any one of claims 1 to 4, wherein the processor is further configured to:

calculate, for each sub-block of the plurality of sub-blocks, a ratio value of the valid page count to a block size; and

select, as the victim sub-block, a sub-block with a smallest ratio value from among the plurality of sub-blocks.

8. The storage device of any one of claims 1 to 7, wherein the processor is further configured to:

manage a garbage collection management table of the plurality of sub-blocks;

update the garbage collection management table according to the garbage collection operation on the plurality of sub-blocks; and

control the garbage collection operation on the plurality of sub-blocks based on the garbage collection management table.

9. The storage device of any one of claims 1 to 8, wherein the processor is further configured to:

manage a mapping table storing physical addresses of the non-volatile memory respectively corresponding to logical addresses received from a host; and

wherein to copy the valid page of the victim sub-block comprises to update the mapping table after copying the valid page of the victim sub-block to the target sub-block.

10. The storage device of any one of claims 1 to 9, wherein the processor is further configured to:

control, in a first mode, a first erase operation on the non-volatile memory in sub-block units; and

control, in a second mode, a second erase operation on the non-volatile memory in block units,

wherein each of the block units comprises at least two sub-blocks.

11. The storage device of any one of claims 1 to 10, wherein the processor is further configured to:

select the victim sub-block having the lowest ratio of the valid page count to the invalid page count from among the plurality of sub-blocks based on at least one of a program/erase cycle count and a page migration time of each sub-block of the plurality of sub-blocks.

12. A storage device, comprising:

a non-volatile memory comprising first sub-blocks and second sub-blocks, each of the first sub-blocks having a first block size and comprising a first plurality of memory cells,

each of the second sub-blocks having a second block size and comprising a second plurality of memory cells, the second block size being different from the first block size; and

a processor configured to independently control a first garbage collection operation on the first sub-blocks having the first block size and a second garbage collection operation on the second sub-blocks having the second block size, based on a block size of the first sub-blocks and the second sub-blocks,

wherein the processor is further configured to:

copy a valid page of a first victim sub-block from among the first sub-blocks to a first target sub-block from among the first sub-blocks, based on a first garbage collection management table of the first sub-blocks, the first victim sub-block having a lowest valid page count from among the first sub-blocks; and

copy a valid page of a second victim sub-block from among the second sub-blocks to a second target sub-block from among the second sub-blocks, based on a second garbage collection management table of the second sub-blocks, the second victim sub-block having a lowest valid page count from among the second sub-blocks.

13. The storage device of claim 12, wherein:

the first garbage collection management table is configured to store a valid page count of each of the first sub-blocks, and

the second garbage collection management table is configured to store a valid page count of each of the second sub-blocks.

14. The storage device of claim 12 or claim 13, wherein:

each of the first sub-blocks is coupled to a first word line group comprising a plurality

of first word lines stacked in a vertical direction,

each of the second sub-blocks is coupled to a second word line group comprising a plurality of second word lines stacked in the vertical direction, and

a number of first word lines comprised by the plurality of first word lines is different from a number of second word lines comprised by the plurality of second word lines.

15. The storage device of claim 12 or claim 13, wherein:

the first sub-blocks respectively correspond to first memory stacks,

each of the first memory stacks extends in a vertical direction on a substrate,

the second sub-blocks respectively correspond to second memory stacks, and

each of the second memory stacks extends in the vertical direction on the first memory stacks.

16. The storage device of any one of claims 12 to 15, wherein the processor is further configured to:

update the first garbage collection management table after copying the valid page of the first victim sub-block to the first target sub-block; and

update the second garbage collection management table after copying the valid page of the second victim sub-block to the second target sub-block.

17. The storage device of any one of claims 12 to 16, wherein the processor is further configured to:

control, in a first mode, a first erase operation on the non-volatile memory in sub-block units; and

control, in a second mode, a second erase operation on the non-volatile memory in

block units,

wherein each of the block units comprise at least two sub-blocks.

18. The storage device of any one of claims 12 to 17, wherein the processor is further configured to:

select the first victim sub-block from among the first sub-blocks based on at least one of a program/erase cycle count and a page migration time of each of the first sub-blocks; and

select the second victim sub-block from among the second sub-blocks based on at least one of a program/erase cycle count and a page migration time of each of the second sub-blocks.

19. An operating method of a processor of a storage device, the operating method comprising:

selecting a victim sub-block from among first sub-blocks and second sub-blocks of a non-volatile memory, each of the first sub-blocks having a first block size, each of the second sub-blocks having a second block size, the second block size being different from the first block size;

copying a valid page of the victim sub-block to a target sub-block having a same block size as the victim sub-block; and

performing an erase operation on the victim sub-block,

wherein the selecting of the victim sub-block comprises at least one of:

selecting, as the victim sub-block, a sub-block having a smallest ratio value of a valid page count to an invalid page count from among the first sub-blocks and the second sub-blocks;

selecting, as the victim sub-block, a sub-block having a largest difference

value between the invalid page count and the valid page count from among the first sub-blocks and the second sub-blocks; and

selecting, as the victim sub-block, a sub-block having a smallest ratio value of the valid page count to a block size from among the first sub-blocks and the second sub-blocks.

20. The operating method of claim 19, wherein:

the first sub-blocks respectively correspond to first memory stacks on a substrate, and

the second sub-blocks respectively correspond to second memory stacks on the first memory stacks.