**Written Assignment 3**

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Q1.

List the value and weight of each item:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 |
|  | 8 | 2 | 5 | 13 | 16 | 1 |
|  | 5 | 3 | 2 | 1 | 6 | 4 |

Firstly, for , and , define

The maximum value of any subset of items of weight at most .

And then for recursion:

Boundary cases:

Let and

Same as that:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 8 | 8 | 8 | 8 | 8 | 8 |
| 2 | 0 | 0 | 0 | 2 | 2 | 8 | 8 | 8 | 10 | 10 | 10 |
| 3 | 0 | 0 | 5 | 5 | 5 | 8 | 8 | 13 | 13 | 13 | 15 |
| 4 | 0 | 13 | 13 | 18 | 18 | 18 | 21 | 21 | 26 | 26 | 26 |
| 5 | 0 | 13 | 13 | 18 | 18 | 18 | 21 | 29 | 29 | 34 | 34 |
| 6 | 0 | 13 | 13 | 18 | 18 | 18 | 21 | 29 | 29 | 34 | 34 |

For

For

For

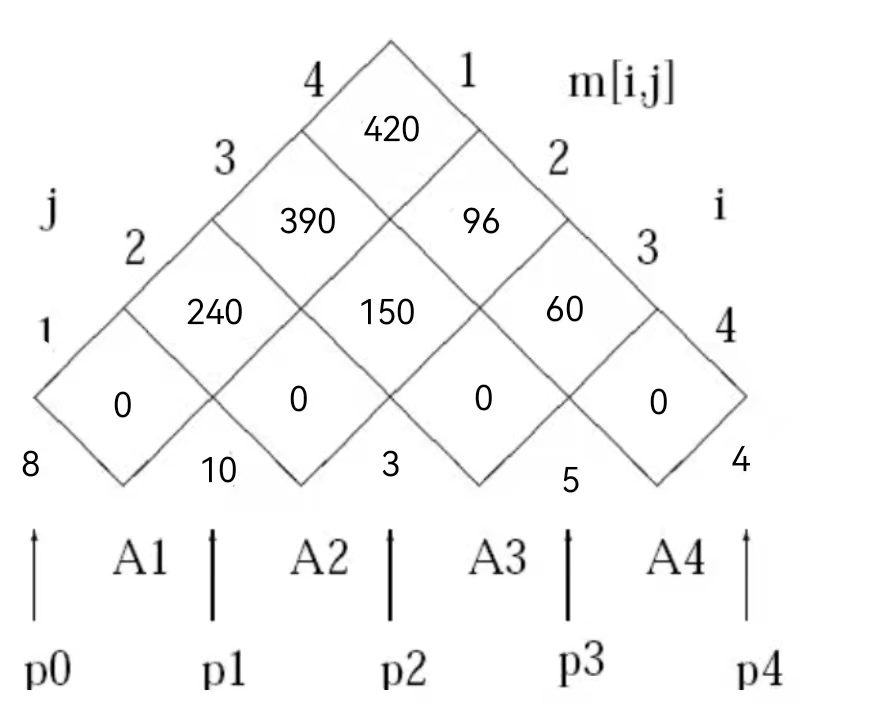
For

To conclude, the optimal value is and the optimal itemset is .

Q2.

For the optimal multiplication sequence, at the last step we should multiply two matrices and minimize the number of . And we can get this question to those of its subproblems. The cost can be described by the following recursion:

which m is represented to the . Then bottom-up computation of



396

180

360

sas

sas

360

sas

Q3.

Using dynamic programming, we record each optimal solution in a matrix with time for time。

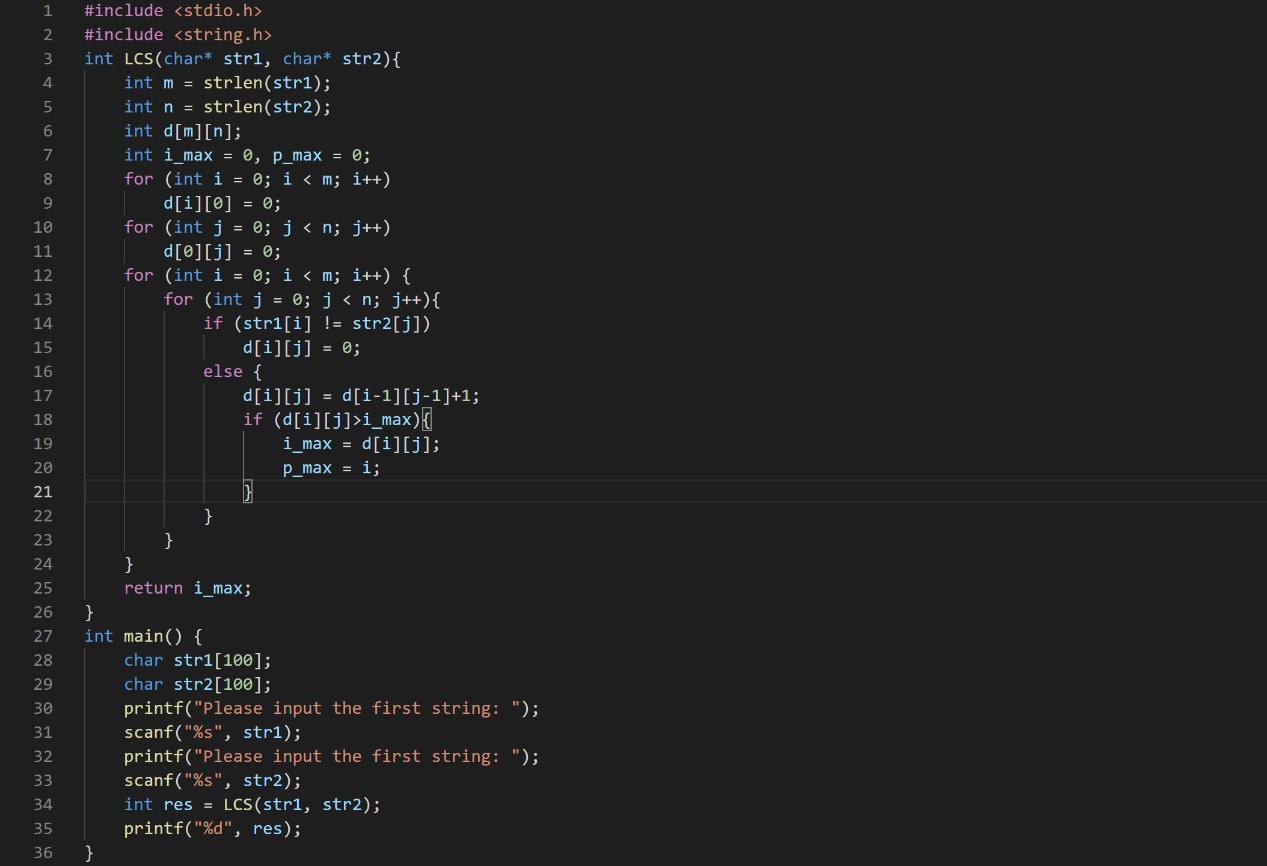
Step1: Create a matrix with identical shape with two strings and initialization it.

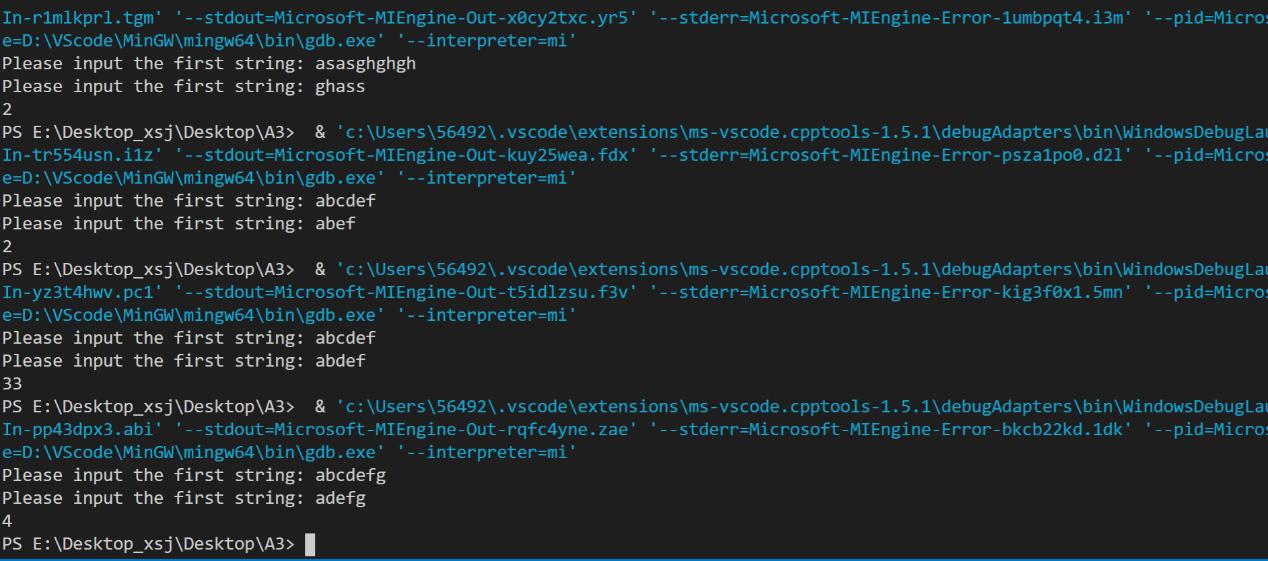
Step2: Traversal matrix (two-dimensional array).

. (In this way it can record the best case in subproblem).

.

Step3: Record the largest number each time during the traversal process.





Q4.

Using dynamic programming, we record each optimal solution in a matrix with time for time。

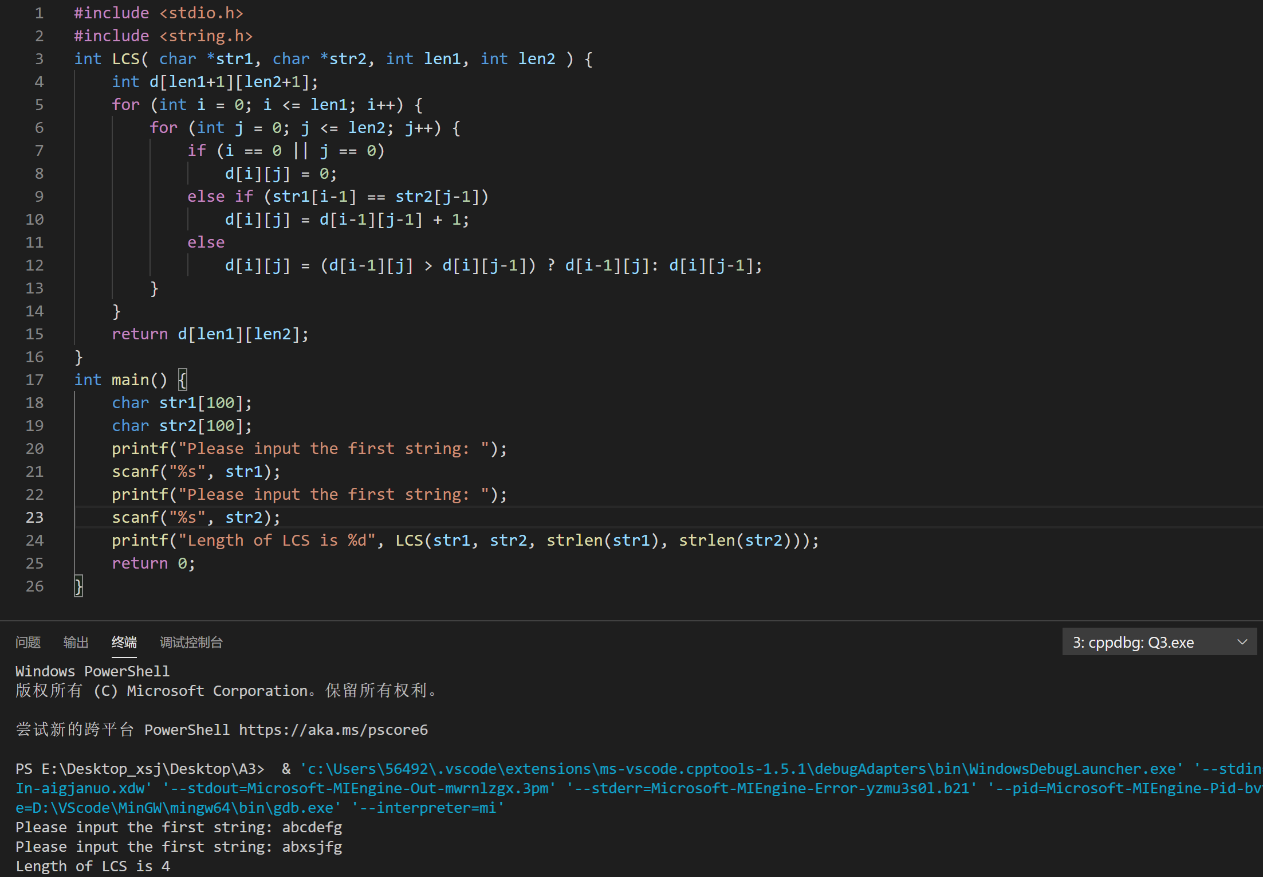
Step1: Create a matrix with identical shape with two strings and initialization it.

Step2: Traverse the two-dimensional matrix, and there two cases:

.

, every time it can get the best solutions.

Step3: Return the last number after traversing and it is just the max one.



Q5.

Firstly, we can count all of the frequency of letters:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| alphabet |  |  |  |  |
|  |  |  |  |  |

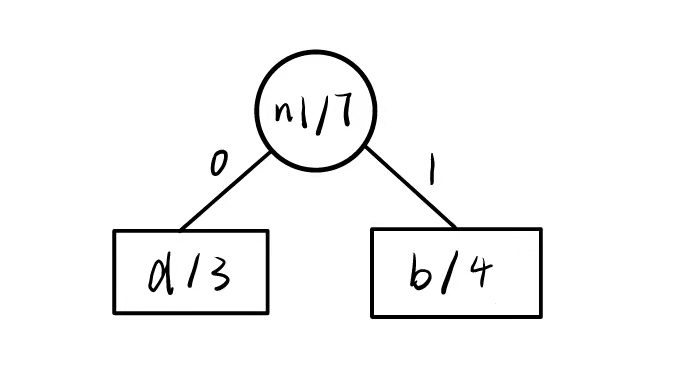
In the fixed-length binary code:

, and required bits to store the file.

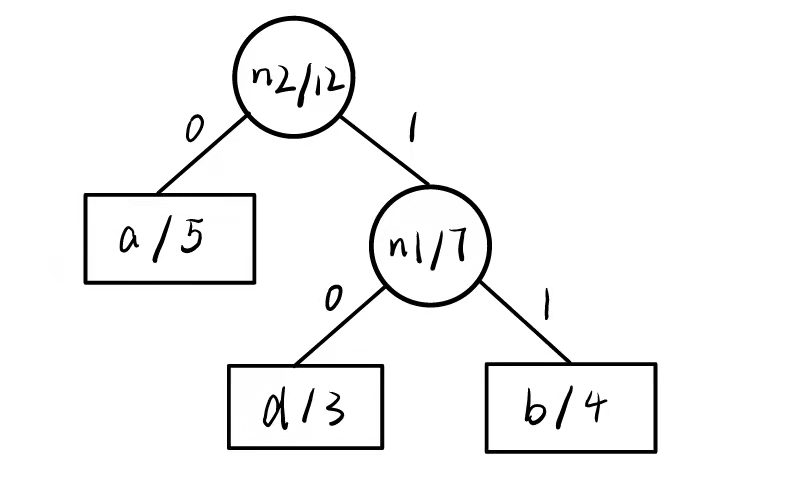
In the variable-length binary code:

Using greedy algorithm for Huffman Coding:

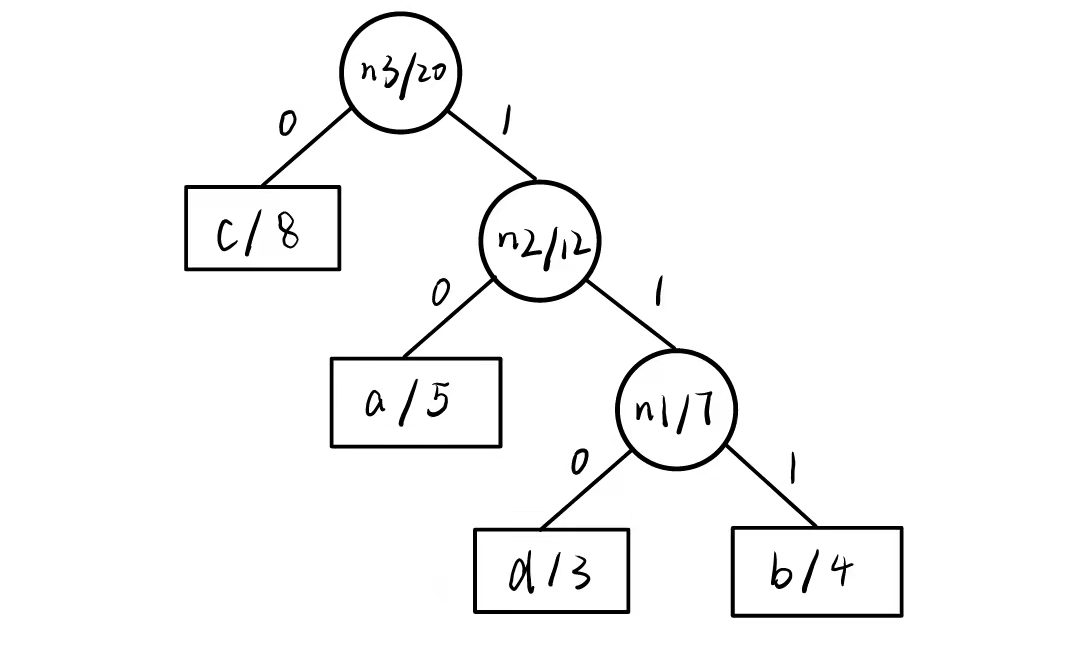
* Step1: Choose the smallest two letter and build the tree ()



* Step2: Continue to choose the smallest two items and merge to the tree ()



* Step3: Merge the last one alphabet to the Huffman tree ()



The left edge connection is 0 and right is 1. The Huffman code is . This coding method required bits to store the file.