Algorithms and Programming

Iniziato	martedì, 21 dicembre 2021, 17:15
Stato	Completato
Terminato	martedì, 21 dicembre 2021, 17:16
Tempo impiegato	10 secondi
Valutazione	**0,00** su un massimo di 15,50 (**0**%)

Domanda 1

Risposta non data

Punteggio max.: 3,00

Given the following C code function:

```
void sort (int **m, int R, int C) {
  int i, j, k, t;
  for (i=0; i<R; i++) {
    for (j=0; j<C-1; j++) {
      for (k=0; k<C-j-1; k++) {
         if (m[i][j]>m[i][j+1]) {
           t = m[i][j]; m[i][j] = m[i][j+1]; m[i][j+1] = t;
        }
      }
    }
  }
  return;
}
```

Evaluate its complexity in terms of the number of total operations. Please, report all intermediate computational steps required to reach the result. Moreover, clearly state the final asymptotic complexity of the algorithm. Appropriately motivate computational steps and results.
Notice that this is an open question, and it will be manually evaluated.

Domanda 2

Risposta non data

Punteggio max.: 1,00

The following expression is given in in-fix notation.
Using its representation as a binary tree, convert it into pre-fix (Polish) and post-fix (Reverse Polish) notation.

```
( A * ( B - C ) ) - ( D + E ) / ( F * ( G - H ) / I )
```

Report the expression in pre-fix notation and in post-fix notation.

Notice that this is an open question, and it will be manually evaluated.

Domanda 3

Risposta non data

Punteggio max.: 1,00

Given the following array of integer values, sort it in ascending order using the counting sort procedure.

```
 3  9  8 11  2  5  3 10  7  4  8  3  2 11  5
```

Which is the value of element C[3] **at the end** of the sorting process (that is, once the original array has been **completely** sorted)? Please, report a single integer value. No other symbols must be included in the response.

Risposta:

La risposta corretta è : 2

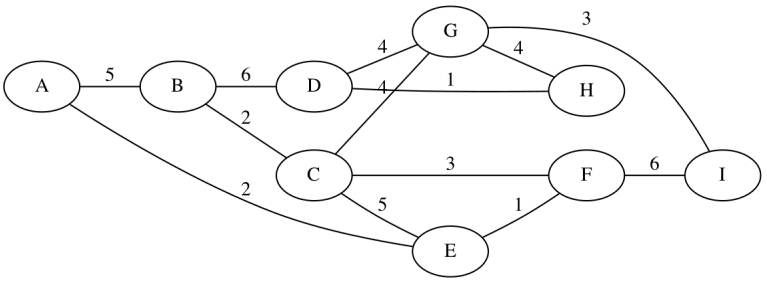
Domanda 4

Risposta non data

Punteggio max.: 1,50

THIS EXERCISE IS ONLY FOR STUDENTS WITH 10 CREDITS IN THEIR CURRICULUM.

Given the following undirected and weighted graph find a minimum spanning tree using the Kruskal algorithm.



Indicate the total weight of the final minimum spanning tree. Report one single integer value. No other symbols must be included in the response. This is an example of the response format: 13

Risposta:

La risposta corretta è : 20

Domanda 5

Risposta non data

Punteggio max.: 1,00

Given the following array of integer values, sort it in ascending order using the insertion sort procedure.

```
10  4  8 -11  5  3  1  7  4  3  2 12 15
```

Display the content of the array just after 6 iterations of the main (outer) loop (i.e., before iteration number 7). Please, show the entire content of the array as a sequence of integer values separated by a single space. No other symbols must be included in the response. This is an example of the response: 0 3 0 6 8 etc.

Risposta:

La risposta corretta è : -11 1 3 4 5 8 10 7 4 3 2 12 15

Domanda 6

Risposta non data

Punteggio max.: 1,00

Given the following array of integer values, perform the **first** step of quicksort to sort the array in ascending order, thus from the initial array generate the right and the left partitions.

```
1 10  6 15  4  8  5  2  7 21 11 19  9
```

Report 3 integer values: The pivot selected on the original array, the pivot you would select on the left partition generated from the original array, and the pivot you would select on the right partition generated (again) from the original array. No other symbol must be included in the response. This is an example of response format: 13 1 10

Risposta:

La risposta corretta è : 9 5 15

Domanda 7

Risposta non data

Punteggio max.: 1,00

A BST contains integer values included in the range 1-1000. Suppose we are looking for the value 0367 is such a BST.
Consider the following sequences of values generated during a search.

0226 0410 0351 0394 0391 0364 0381 0376 0374 0371 0367
0616 0093 0286 0443 0434 0426 0339 0340 0362 0419 0390 0354 0378 0370 0366 0367
0604 0348 0410 0383 0362 0364 0374 0366 0367
0484 0302 0327 0347 0482 0459 0399 0362 0385 0380 0370 0361 0367

Indicate which sequences (numbered starting from 1, as 1, 2, 3, 4) are correct. Please, report the numbers indicating the correct sequences (e.g., 1 4 if sequences number 1 and 4 are correct). These numbers must be separated by a single space and reported in ascending order. No other symbols must be included in the response. This is an example of the response format: 1 4 etc.

Risposta:

La risposta corretta è : 1 3

Domanda 8

Risposta non data

Punteggio max.: 1,50

Insert the following sequence of keys into an initially empty hash table. The hash table has a size equal to 23.
Insertions occur character by character using open addressing with double hashing. Use function h1(h)=k%M and h2(h)=1+(k%97).
Each character is identified by its index in the English alphabet (i.e., A=1, ..., Z=26).
Equal letters are identified by a different subscript (i.e., A and A and A become A1 and A2 and A3).

```
R A D A R A
```

Indicate in which elements are placed the last three letters of the sequence, i.e., A, R, and A, in this order. Please, report your response as a sequence of integer values separated by one single space. No other symbols must be included in the response. This is an example of the response format: 3 9 1

Risposta:

La risposta corretta è : 3 14 5

Domanda 9

Risposta non data

Punteggio max.: 1,50

Suppose to have an initially empty priority queue implemented with a **maximum** heap. Consider the following sequence of integers and "*" characters, where each integer corresponds to one insertion into the priority queue and each character "*" corresponds to one extraction.

```
1  3  8  7 12 15 21 *  *  *
```

Report the sequence of values as they are stored in the array representing the priority queue at the end of the entire process. Please, show the entire content of the array as a sequence of integer values separated by a single space. No other symbols must be included in the response. This is an example of the response: 0 3 2 6 8 etc.

Risposta:

La risposta corretta è : 8 7 3 1

Domanda 10

Risposta non data

Punteggio max.: 1,50

THIS EXERCISE IS ONLY FOR STUDENTS WITH 12 CREDITS IN THEIR CURRICULUM.

The following capital letters are given with their absolute frequency.

```
A:12 B:9 C:14 D:3 E:7 F:5
```

Find an optimal Huffman code for all symbols in the set using a greedy algorithm. Indicate the maximum number of bits that must be used to represent the symbol/symbols with the lowest frequency and the number of symbols that can be encoded with that same maximum number of bits. For example, if 3 letters must be represented with 5 bits (and all others with less than 5 bits) report as a response: 5 3. No other symbols must be included in the response.

Risposta:

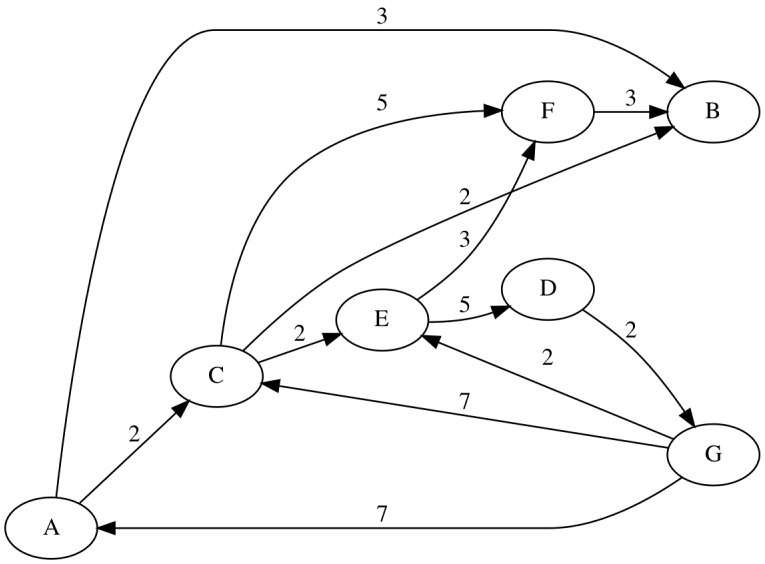
La risposta corretta è : 4 2

Domanda 11

Risposta non data

Punteggio max.: 1,50

Given the following directed and weighted graph, apply Dijkstra's algorithm to find all shortest paths connecting node A with all the other nodes. When necessary, consider nodes and edges in alphabetical order.



Report the shortest paths to all vertices. Please, indicate the shortest path to all vertices sorted in alphabetic order (i.e, display the shortest path for A B C D, etc.). Report a sequence of integer values separated by one single space. No other symbols must be included in the response. This is an example of the response: 0 3 2 6 8 etc.

Risposta:

La risposta corretta è : 0 3 2 9 4 7 11