

Politecnico
di Torino

Algorithms and Programming

Iniziato martedì, 21 dicembre 2021, 17:07**Stato** Completato**Terminato** martedì, 21 dicembre 2021, 17:07**Tempo impiegato** 14 secondi**Valutazione** 0,00 su un massimo di 17,50 (0%)**Domanda 1**

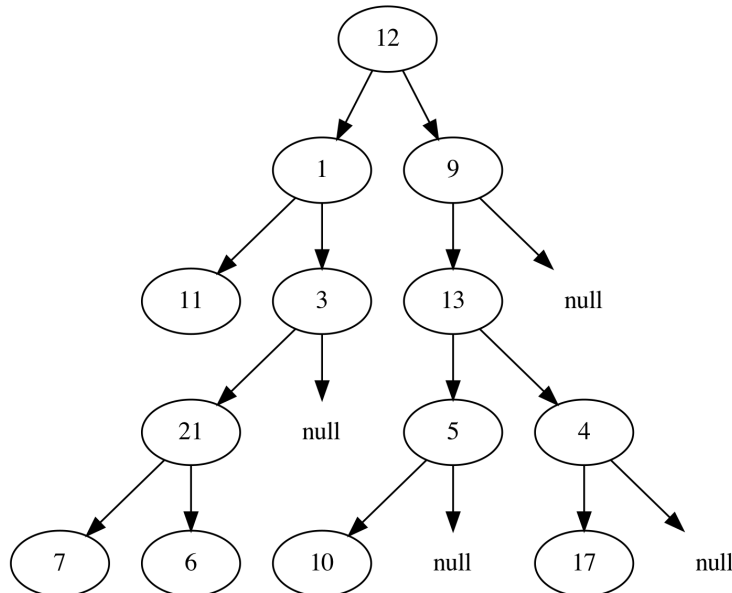
Risposta non data

Punteggio max.:
0,50

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

The following binary tree is given.

Visit it in post-order. Please, report the sequence of keys displayed by the visit on the same line and separate numbers with a single space. No other symbols must be included in the response. This is an example of the response format: 23 4 5 etc.



Risposta:



La risposta corretta è : 11 7 6 21 3 1 10 5 17 4 13 9 12

Domanda 2

Risposta non data

Punteggio max.:
2,00

Strings of undefined length are used as keys to access a hash table. Report the **C implementation** of a proper **hash function**.

Specify and explain (in plain English) how to select the algorithm and how to avoid overflows during the computation of the hash function. Motivate all choices.

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

Domanda 3

Risposta non data

Punteggio max.:
1,50

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.

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

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 symbols must be included in the response. This is an example of response format: 13 1 10

Risposta:



La risposta corretta è : 11 7 19

Domanda 4

Risposta non data

Punteggio max.:
1,50

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

Use the Knuth's sequence $h = 3h + 1$, i.e., 1, 4, 13, etc.

13 9 15 9 11 2 5 0 3 1 4 23 3 7

Display the content of the array just before the main (outer) loop iteration with $h=1$. 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 : 3 1 4 0 3 2 5 9 7 9 15 23 11 13

Domanda 5

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.

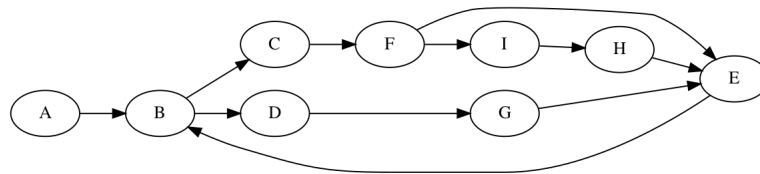
Notice that this is an open question and it will be manually evaluated.

Domanda 6

Risposta non data

Punteggio max.:
1,50**THIS EXERCISE IS ONLY FOR STUDENTS WITH 10 CREDITS IN THEIR CURRICULUM.**

Visit the following graph in depth-first, starting at node A. Label nodes with discovery and end-processing times. Start with the discovery time set to 1 on A. When necessary, consider nodes and edges in alphabetic order.



Report the end-processing time of vertices A, B, and C (in this order). Report a sequence of 3 integer values separated by one single space. No other symbols must be included in the response. This is an example of the response: 15 13 2

Risposta:



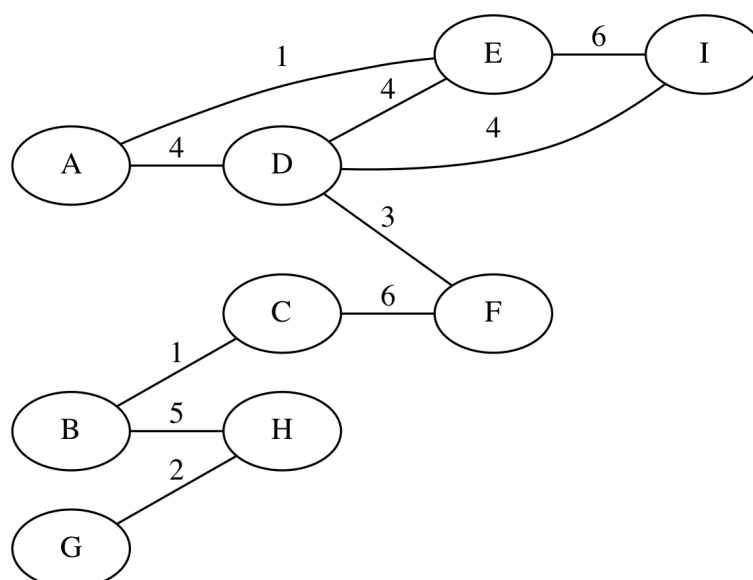
La risposta corretta è : 18 17 12

Domanda 7

Risposta non data

Punteggio max.:
1,50

Given the following undirected and weighted graph find a minimum spanning tree using 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 : 26

Domanda 8

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:10 B:13 C:17 D:15 E:11

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 : 3 2

Domanda 9

Risposta non data

Punteggio max.:
2,00**THIS EXERCISE IS ONLY FOR STUDENTS WITH 12 CREDITS IN THEIR CURRICULUM.**

Given an initially empty BST, perform the following sequence of operations on the BST root. Each positive value indicates a root insertion and each negative value a node extraction.

9 3 7 16 13 29

Indicate the structure of the final BST reporting all nodes' key from top to bottom (from root to leaves) and from left to right (on each tree level). Please, report all nodes' key 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 format: 23 4 5 3 etc.

Risposta:



La risposta corretta è : 29 13 7 16 3 9

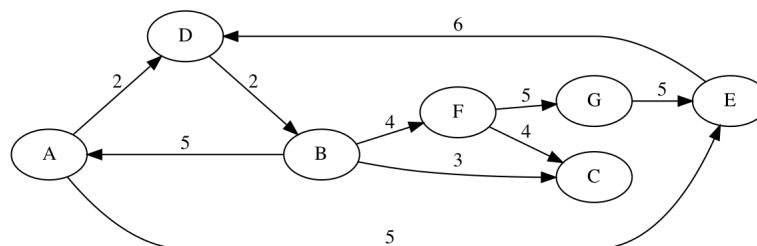
Domanda 10

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 vertices C, F, and G (in this order). Report a sequence of 3 integer values separated by one single space. No other symbols must be included in the response. This is an example of the response: 15 13 18

Risposta:



La risposta corretta è : 7 8 13

Domanda 11

Risposta non data

Punteggio max.:
1,50**THIS EXERCISE IS ONLY FOR STUDENTS WITH 10 CREDITS IN THEIR CURRICULUM.**

Given the following sequence of integers stored into an array, turn it into a heap, assuming to use an array as an underlying data structure. Assume that, in the end, the largest value is stored at the heap's root.

Then, execute the first two steps of heapsort on the heap built at the previous step.

7 8 10 19 3 5 6 21

Report the final content of the entire array at the end of the above 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 : 10 8 6 7 3 5 19 21

Domanda 12

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 19.

Insertions occur character by character using **open addressing with linear probing**. 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 become A1 and A2).

T H E G E N T L E M A N

Indicate in which elements are placed the last three letters of the sequence, i.e., M, A, and N, 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 14 11

Risposta:



La risposta corretta è : 13 3 15