

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 7

LEFEL 7

EXAMINATION PERIOD
MAY 2024

CYFNOD ARHOLIADAU
MAI 2024

MODULE CODE: ACCA7003
OO PROGRAMMING

TIME: 2 HOURS

ANSWER 3 OUT OF 4 QUESTIONS.
ALL QUESTION CARRY EQUAL MARKS

Equipment or materials required –Approved Calculators;

Adnoddau neu ddefnyddiau sydd eu hangen -Approved Calculators

QUESTION ONE

- a) An algorithm has a running time, R_t given by:-

$$R_t = n^2 + n \log n + 3n + 2.5$$

where n is the number of items input into the algorithm. Using “big-O” notation, state the computational complexity of this algorithm and explain your answer.

[6 marks]

- b) Use pseudocode to illustrate programming structures that have complexity $O(1)$, $O(n)$ and $O(n^2)$ and explain your answers.

[9 marks]

- c) Using the ideas of dynamic memory allocation and the concept of a list node, describe using pseudo-code a detailed algorithm for a function that will add an item to a double linked list. In your answer comment on any potential problems associated with your implementation.

[10 marks]

Please Turn Over

QUESTION TWO

- a) Describe what is meant by the term “hashing” in the context of referencing records in a table. In your answer describe steps involved.

[5 marks]

- b) An item is to be inserted into an empty table using the separate chaining (open hashing) method to resolve collisions. The hash function is given by :

$$h(K) = K \bmod m$$

where the table size, $m = 7$ and K is the key to be inserted.

Calculate the table address for a record key value of 17 and draw a diagram to illustrate the table after insertion of this key. A second key has a value of 38. Calculate the table address and draw a diagram to show the updated table after insertion of the key.

[10 marks]

- c) Analyse the separate chaining approach to hashing. In your answer identify the advantages, disadvantages and potential implementation problems with this method.

[10 marks]

Please Turn Over

QUESTION THREE

- a) Provide an algorithm that implements an iterative depth first search using a stack data structure. Analyse this algorithm and hence state its space and time complexity.

[8marks]

- b) Apply your algorithm to the graph of figure Q3, showing the contents of the stack after each iteration of the loop.

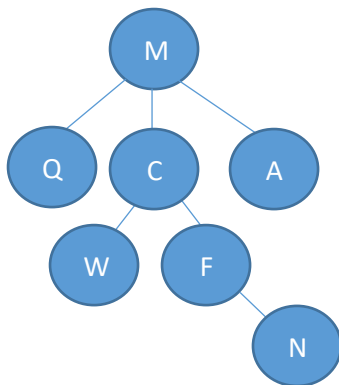


Figure Q3

[7 marks]

- c) Explain how your depth first search algorithm might be modified to perform, instead, a breadth first search. Apply your BFS algorithm to the graph of figure Q3, above.

[10 marks]

Please Turn Over

QUESTION FOUR

- a) Show by means of a diagram how a binary search tree would be constructed given the following list of unordered numbers: 74, 32, 15, 5, 68, 80, 87, 5, 17, 75

Give you reasons for the placement of each value.

[6 marks]

- b) Using the tree shown in figure Q4, perform an in-order traversal of the tree writing down the data read in the order in which the nodes are visited (ensure you indicate which is the first node visited in your answer). Repeat this process using a pre-order and post-order traversal.

[12 marks]

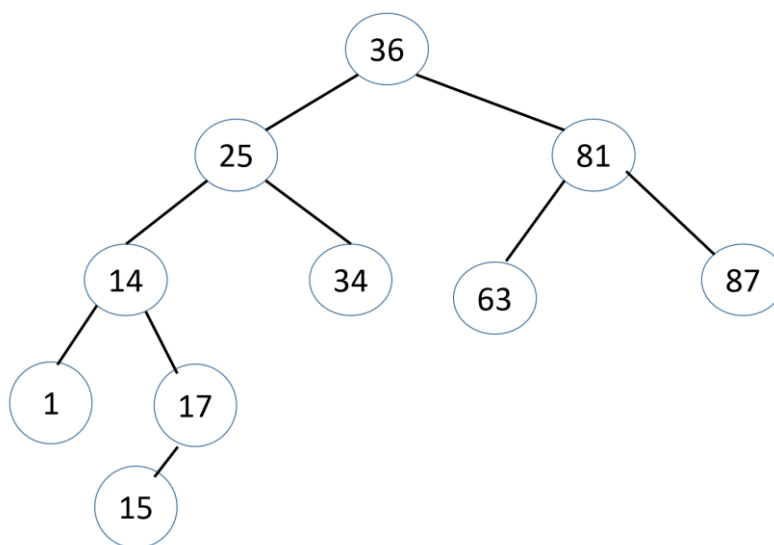


Figure Q4

- c) Demonstrate with the aid of program code or pseudo code the process required to delete the number 81 from the binary tree of figure Q4.

[7 Marks]

Diwedd/End