University of Engineering & Management, Kolkata

End Semester Examination, January, 2022

Programme Name: Master in Computer Application Semester: 1st

Course Name: Data Structures with C

Course Code: MCA103

Full Marks: 100 Time: 3 Hours

GROUP – A (20 marks)

Answer the following questions. Each question is of 2 marks **10 x 2 = 20**

1. i) Define Big – O notation.
   ii) Compare Malloc with Calloc.
   iii) How is it determined memory allocation while creating a new node in linked list?
   iv) What is the utility of NULL pointer in a linked list?
   v) Why do we use multiple queues?
   vi) Convert the following infix expression to its equivalent prefix expression: A+B*C/D.
   vii) What is the difference between pop () and any normal deletion function?
   viii) What is the utility of height balanced tree?
   ix) Define adjacent vertices.
   x) Mention best case and average case time complexity of selection sort technique.

GROUP – B (30 marks)

Answer the following questions. Each question is of 5 marks **6 x 5 = 30**

2. i) State one problem of a single linked list. **2 + 3**
   ii) How to overcome that? Justify your answer
3. Write a program in C for Post Order Traversal in a BST.
4. What is collision? Explain the various techniques to resolve a collision. Which technique do you think is better and why?
5. **A.** Consider the loop given below:

```
for (i=0;i<100;i+=3)
        statement block
```

Explain the efficiency of the above code segment as a function of n [f(n)].

OR

B. Consider the loop given below:

```
for (i=0;i<10;i++)
        for (j=0;j<10;j*=2)
          statement block
```

Explain the efficiency of the above code segment as a function of n [f(n)].

6. **A.** Write a C program to insert an element into the queue using linked list.

OR

B. Explain the overflow condition of a double ended queue(implemented using array).

7. **A.** Write down the algorithm of BFS technique.

OR

B. Write down the algorithm of DFS technique.

GROUP - C (50 Marks)

5 x 10 = 50

Answer the following questions. Each question is of 10 marks

8. **i)** In the context of Omega (Ω) notation, f(n)<=cg(n), where c is a constant. **6 + 4**

   a) What does function g(n) signify?

   b) Explain Best case Ω and Worst case Ω with suitable example.

   c) Provide two examples each of functions in Ω(n3) and of functions not in Ω(n3).

   ii) Explain Theta (θ) notation.

9. Write an algorithm for insertion and deletion of an element in a linear queue using:

   a) array representation

   b) singly linked list representation.

10. **A.** Write ENQUEUE(), DQUEUE() and DISPLAY() C functions for circular queue using array.

    OR

    B. Write ENQUEUE(), DQUEUE() and DISPLAY() C functions for circular queue using linked list.

11. **A. i)** Write down an algorithm to sort a doubly linked list. **5 + 5**

    ii) Write a C program to add two matrices using array and store the result is a third array.

    OR

    B. Write a C program to create a single linked list at first, and then show its second lowest element.

12. **A.** Consider a hash table with size = 10. Using quadratic probing, insert the keys 27, 72, 63, 42, 36, 18, 29, and 101 into the table. Take c1 = 1 and c2 = 3.

    OR

    B. Consider a hash table with size = 11. Using double hashing, insert the keys 27, 72, 63, 42, 36, 18, 29, and 101 into the table. Take h1 = k mod 10 and h2 = k mod 8.

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University of Engineering & Management, Kolkata

End Semester Examination, January, 2022

Programme Name: Master in Computer Application Semester: 1st

Course Name: Computer Organisation and Architecture

Course Code: MCA101

Full Marks: 100 Time: 3 Hours

GROUP – A (20 marks)

Answer the following questions. Each question is of 2 marks **10 x 2 = 20**

1. i) What is excess-3 code? Why it is known as self complementing code?
   ii) What is universal gate and why they called so?
   iii) Find the r's and (r-1)'s complement of $(1001)_2$.
   iv) Define Minterms & Maxterms.
   v) Mention the difference between a DEMUX and MUX.
   vi) How many possible outputs would a decoder have with a 6-bit binary input?
   vii) How JK flip flop can be operated as a toggle flip flop.
   viii) Derive the characteristic equation of T flip flop.
   ix) What is Von-Neuman based computer architecture?
   x) State the function of a cache memory.

GROUP – B (30 marks)

Answer the following questions. Each question is of 5 marks **6 x 5 = 30**

2. Write a short note on Master-Slave JK flip flop.
3. Write a short note on Auxiliary memory and cache memory.
4. Draw and explain each steps of non-restoring division algorithm.
5. **A.** Minimize the function using k-map: F (A, B, C, D) = A'B'D+ABC'D'+A'BD+ABCD'.

   OR

   B. Obtain minimal SOP expression for $Y= \Sigma m(1,5,7,13,14,15,) + \Sigma d(6,9,14)$.
6. **A.** What do you mean by Speedup, efficiency and throughput of a pipelined processor?

   OR

   B. Draw and explain the flowchart of floating point addition process.
7. **A.** Implement a full subtractor using two half subtractor and one OR gate.

   OR

   B. What is SISO? What are the characteristics of SISO? Explain with diagram.

GROUP - C (50 Marks)

$5 \times 10 = 50$

Answer the following questions. Each question is of 10 marks

8. Draw the flowchart for the multiplication of unsigned numbers. Multiply (15) and (15) using above algorithm. Verify the result.

9. Draw the flowchart for restoring type division algorithm. Divide 36 by 4 using above algorithm.

10. **A.** **i)** Define r's complement and (r-1)'s complement of binary, octal, decimal and hexadecimal number system with example.**ii)** Develop a logic gate circuit to verify even or odd numbers of '1' are present in the 3 bit data.

    OR

    B. Perform the following: **i)** Find two's complement of the numbers: **a)** 10010010, **b)** 01100111

    ii) Add the binary numbers: A = 10000001 B = 11111111 **iii)** Design and explain the operation of a BCD to Excess-3 code converter using all basic gates.

11. **A.** **i)** Design and explain the full adder circuit using two half adder circuit.
    ii) Design and explain a Decimal to BCD Encoder circuit.

    OR

    B. **i)** Implement the Half Subtractor using Multiplexer along with the truth table.
    ii) Design and explain an Octal to Binary Encoder.

12. **A.** Convert from **i)** SR to JK, **ii)** D to T.

    OR

    B. Explain, with the help of a neat diagram, the functioning of a MOD-8 asynchronous UP/DOWN Counter.

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