Computer Science III Midterm Exam **Indian Statistical Institute**
Duration: 2 hrs, Total Marks 100

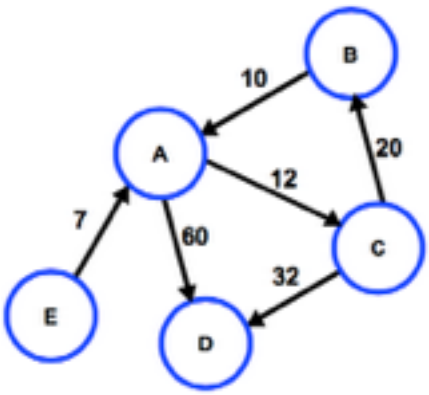
Answer the following - 20 marks total, 2 marks each

1. An example of a Stack application is …….
2. An example of a Queue application is …….
3. Use a …… to use space more efficiently in a queue
4. Trees are …… data structures
5. A sequence of nodes and edges connecting a node with another node in a graph is called ……..
6. Depth-first search uses a …… data structure to implement recursion
7. Breadth-first search uses a …… data structure to correctly remember visited nodes.
8. A binary tree in which the key value of the parent is always higher than that of its children with the root holding the maximum value is called a …….
9. A sorting technique that breaks down an array into single elements and puts them back in order is called …….
10. A sorting technique that is akin to sorting a deck of playing cards is called …….

Answer the following - 20 marks

1. Define the following data structures in C and illustrate each using diagrams. In each case label relevant nodes using standard convention. **5 marks each**
   a. Doubly linked list with integer data 10 - 50 in each node
   b. Stack with the following values 2, 7, 8, 3, 0, 9
   c. Circular queue with the following values 4, 2, 0, 5, 8, 1, 9, 3, 7, 6
   d. A max heap 34, 7, 20, 56, 78, 102, 15, 9, 27, 390
   e. A directed graph with vertices a, b, c, d, e and edges { (a,b), (a,e), (b,c), (b,e), (c,d), (c,e)}

2. Given the following graph, answer the following and illustrate any algorithms using the appropriate data structure for each method. Illustrate each step neatly and show the trace. - **30 marks**
   I. Show the adjacency matrix and adjacent list for the graph - **5 marks**
   II. Depth-First-Traversal - **10 marks**
   III. Write a recursive function in C that takes an integer that is the key value for the node to be searched, searches a tree using DFS and returns a pointer to the node. - **5 marks**
   IV. Breath-First-Traversal - **10 marks**



3. Do the following. - **25 marks**
   a. Write the pseudocode for the Infix to postfix conversion algorithm - **10 marks**
   b. Convert x-y*(5+3^2*3)^2+(x*z)-10 to postfix. Show the output string and stack values at each step. - **10 marks**
   c. Write the stack trace for the postfix evaluation of the same expression and evaluate the expression for values of x=10, y=2, z =4 - **5 marks**