

# Bangabandhu Sheikh Mujibur Rahman Science and Technology University

## Department of Computer Science & Engineering

2<sup>nd</sup> Year 1<sup>st</sup> Semester B.Sc. Engineering Examination-2020

Course Code: CSE205

Course Title: Java Technology

Full Marks: 60

Time: 3 hours

Answer Three questions from each section

### Section A

- Q.1 (a) Why is object oriented design used for large scale software projects such as java? 3  
(b) Explain about Public, Private and protected access specifiers with proper example. 3  
(c) What is interface, why do we need interface? justify your answer with a proper example. 4
- Q.2 (a) Why java is Object-oriented, Platform independent and Multi-threaded? 3  
(b) Briefly describe Encapsulation, Polymorphism and Inheritance with real life example. 5  
(c) Write down the difference between constructor and method in java. 2
- Q.3 (a) What are the functions of class constructors? 3  
(b) Explain function overriding and function overloading with proper examples. 4  
(c) Why bytecodes are important in java. What are the functions of JVM? 3
- Q.4 (a) Explain the use of the final keyword in variable, method and class. 3  
(b) Explain class and objects in java? 3  
(c) Translate the following algorithm into Java Code: 4  
Step1: Declare a double variable named **miles** with initial value 100  
Step2: Declare a double constant named **KILOMETERS\_PER\_MILE** with value 1.609  
Step3: Declare a double variable named **kilometers**, multiply **miles** and **KILOMETERS\_PER\_MILE**, and assign the result to **kilometers**.  
Step4: Display **kilometers** to the console.

### Section B

- Q.5 (a) What is a Thread? How many ways a thread can be created, answer it with proper examples? 3  
(b) Explain Thread life cycle. 4  
(c) How does an exception propagate in the code? give example. 3
- Q.6 (a) What do you mean by class variable? What do you understand by an instance variable and a local variable? 4  
(b) What are the advantages of Packages in Java? Give examples. 3  
(c) Multiple inheritance is not allowed in java but Multilevel is allowed; justify it. 3
- Q.7 (a) What do you mean by data encapsulation, JDK, JVM, JRE? 4  
(b) Write output of the following code: 3  

```
public class InterviewBit{
    final static int a=10;
    public static void main(String[] args)
    {
        a++;
        System.out.println(a);
    }
}
```

  
(c) Use relevant properties to highlight the differences between interfaces and abstract classes. 3
- Q.8 (a) Do final, finally and finalize keywords have the same function? 3  
(b) When can you use super keyword? 2  
(c) What are the differences between C++ and Java? Can the static methods be overloaded? Can the static methods be overridden? 45

**SECTION-A**

1. a) Find out the 11's and 10's complement of  $(5192.19)_{11}$ . 3
- b) Implement the function  $F = \Pi(1, 2, 3, 4, 5, 7)$  with only NAND gates. 3
- c) Simplify the function  $F = \Sigma(2, 3, 5, 7, 8, 9, 10, 11, 13, 15)$  by using the tabulation method. 4
2. a) Design a logic circuit that converts a BCD number into a Gray code number. 4
- b) Design a 4-input priority encoder with the priority  $2 < 1 < 0 < 3$ . 3
- c) Design a full subtractor with a decoder and basic logic gates. 3
3. a) Implement the function  $F = \Sigma(1, 3, 4, 5, 7, 8, 9, 13, 15)$  with only one 4X1 MUX. 4
- b) Design a combinational circuit that compares two 4-bit numbers A and B to check whether B is 2's complement of A. 4
- c) Design a 4X1 MUX using two 2X1 MUXs. 2
4. a) Design a sequential circuit that performs the following operations on a 4-bit binary number using necessary MUXs with selectors  $S_1$  and  $S_0$ . 8

$S_1$	$S_0$	Operation
0	0	Set
0	1	Reset
1	0	Shift left
1	1	1's complement

- b) What is carry propagation? Why is it used? 2

**SECTION-B**

5. a) What do you mean by multiplexers? Implement a 8-to-1 multiplexer using two 4-to-1 and one 2-to-1 multiplexer. 6
- b) Make a 2-to-1 multiplexer using NAND gate. 4
6. a) A sequential circuit has following equations- 3  
 $A(t+1) = (CD' + C'D)x + (CD + C'D')x'$   
 $B(t+1) = A$   
 $C(t+1) = B$   
 $D(t+1) = C$   
 Obtain the sequence of states when  $x = 1$ , starting from state  $ABCD = 0001$ .
- b) What is self-correcting counter? Design a synchronous counter with T flip-flop for the following sequence.  $000 \rightarrow 001 \rightarrow 011 \rightarrow 100 \rightarrow 110 \rightarrow 111$ . If state 010 is encountered, it moves to valid state 011 and for state 101, it moves to state 110. 5
- c) What are the conditions for state reduction? 2
7. a) There are 4 states as 00, 01, 10, 11 for a machine. It moves from a state to another which 1's complement of the previous state when input  $x = 0$  and 2's complement of the previous state when input  $x = 1$ . Design the sequential circuit with JK flip-flop. 6
- b) Convert a D flip-flop to T flip-flop. Use necessary gates. 2
- c) Derive the characteristic table and the characteristic equation for a JK flip-flop. 2
8. a) Explain the memory unit and its operating principles with block diagram. 4
- b) Design a 4-bit Johnson Counter. What is the disadvantage of Johnson Counter? What is the difference between Johnson Counter and Ring Counter? 4
- c) Write the difference between ROM and PLA. 2

- i. Answer **SIX** questions, taking any **THREE** from each section.
- ii. All questions are of equal values

**Section A**

1. a) Define Data Structure. Why do we need to know about different types data structures in the computer engineering field? 1+3
- b) What do you mean by garbage collection? Define Overflow and Underflow. 1+2
- c) What do you mean by the complexity of an algorithm? Discuss briefly the time-space tradeoff of algorithms. 1+2
2. a) What are the limitations of linear search algorithm? 2
- b) Apply binary search technique to the following sorted array, when search item is 40.  
Array: 11, 22, 30, 33, 40, 44, 55, 60, 66, 77, 80, 88, 99 4
- c) Let's consider an array with values: 5, 1, 6, 2, 4, 3. Sort this array using the Bubble Sort algorithm. Show the first step's (pass 1) comparisons in detail. 4

3. Consider the following link list.

START	INFO	LINK
4	1	A
	2	B
	3	
	4	C
	5	D
	6	
	7	E
	8	F
AVAIL		
3		

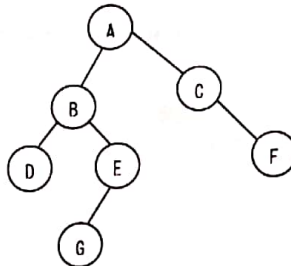
- a) Find the sequence of characters in the list. 1
- b) Suppose F and then C are deleted from the list and then G is inserted at the beginning of the list. Find the final structure. 2
- c) Suppose C and then F are deleted from the list and then G is inserted at the beginning of the list. Find the final structure. 2
- d) Suppose G is inserted at the beginning of the list and then F and then C are deleted from the structure. Find the final structure. 2
- e) What is two-way list? Write down the advantages and disadvantages of it. 3
4. a) Consider the following stack, where STACK is allocated N = 6 memory cells:  
STACK: AAA, DDD, EEE, FFF, GGG, \_\_\_\_\_  
Describe the stack as the following operations take place:  
(i) PUSH(STACK, KKK), (ii) POP(STACK, ITEM), (iii) PUSH(STACK, LLL),  
(iv) PUSH(STACK, SSS), (v) POP(STACK, ITEM) and (vi) PUSH(STACK, TTT). 3
- b) Consider the following arithmetic expression P, written in postfix notation:  
P: 12, 7, 3, -, /, 2, 1, 5, +, \*, +  
(i) Translate P, by inspection and hand, into its equivalent infix expression.  
(ii) Evaluate the infix expression. 3
- c) Define priority queue. Consider the following queue of characters, where QUEUE is a 4 circular array which is allocated six memory cells:  
FRONT = 2, REAR = 4, QUEUE: \_, A, C, D, \_, \_  
(For notational convenience, we use "\_" to denote an empty memory cell). Describe the queue as the following operations take place:  
(i) F is added to the queue  
(ii) K, L, and M are added to the queue  
(iii) R is added to the queue  
(iv) S is added to the queue



## Section B

5. a) What is heap? State max-heap and min-heap property. 1+2  
 b) Write the Huffman's Algorithm. Suppose A, B, C, D, E, F, G and H are 8 items and suppose they are assigned Weights as follows: 4  
 Data Item : A B C D E F G H  
 Weight : 22 5 11 19 2 11 25 5  
 Construct a tree using Huffman's algorithm.

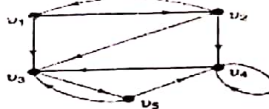
6. a) Deduce the preorder, in order, and post order sequences for the following binary tree: 3



R-L-R.

6. a) Consider the following list of letters is inserted into an empty binary search tree: 4+3  
 J, R, D, G, T, E, M, H, P, A, F, Q  
 i. Find the final tree T (show each step separately) and  
 ii. Describe the tree after the node R is deleted 3  
 b) Suppose inorder and preorder traversals of a binary tree are as follows:  
 Inorder: D B H E A I F J C G  
 Preorder: A B D E H C F I J G  
 Draw the binary tree.

7. a) Consider the following directed graph G. 4  
 (i) Find the indegree and outdegree of each node. (ii) Find the number of simple paths from v1 to v4. (iii) Are there any sources or sinks?



- b) Suppose the graph G (Figure 7) represents the daily flights between cities of some airline. 6  
 Now find the minimum path from the city A to city E using BFS, where the each edge has length 1.



Figure 7: A directional graph G

8. a) Suppose an array A contains 6 elements as follows: 99 2 34 18 76 14 3  
 Insertion sort algorithm is applied on array A to sort its elements. Depict the state of the array after each pass of the algorithm.  
 b) Suppose S is the following list of 14 alphabetic characters: 4  
D A T A S T R U C T U R E S  
 Suppose The characters in S are to be sorted alphabetically. Use the quicksort algorithm to find the final position of the first character D.  
 c) Suppose 9 cards are punched as follows: 348, 143, 361, 423, 538, 128, 321, 543, 366. 3  
 Sort the numbers using Radix sort.