Course No.:CSE201

Course Title: Data Structure

Full Marks: 60

Times: 3 Hours

N.B.:
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. (4)
   Array: 11, 22, 30, 33, 40, 44, 55, 60, 66, 77, 80, 88, 99

   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
	2	B	8
AVAIL	3		6
3	4	C	7
	5	D	0
	6		0
	7	E	1
	8	F	5

   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: 3
   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).

   b) Consider the following arithmetic expression P, written in postfix notation: 3
   P: 12, 7, 3, −, /, 2, 1, 5, +, *, +
   (i) Translate P, by inspection and hand, into its equivalent infix expression.
   (ii) Evaluate the infix expression.

   c) Define priority queue. Consider the following queue of characters, where QUEUE is a circular array which is allocated six memory cells: 4
   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 4
they are assigned Weights as follows:

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.

c) Deduce the preorder, in order, and post order sequences for the following binary tree: (3)
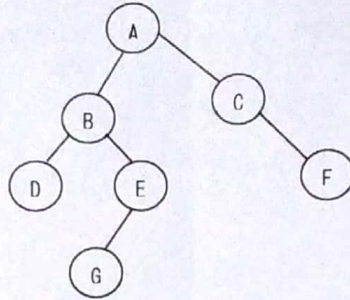
6. a) Consider the following list of letters is inserted into an empty binary search tree: (4+3)
J, R, D, G, T, E, M, H, P, A, F, Q
i. Find the final tree T (show each step separately) and
ii. Describe the tree after the node R is deleted

b) Suppose inorder and preorder traversals of a binary tree are as follows: (3)
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?
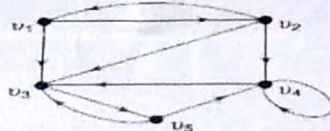
b) Suppose the graph G (Figure 7) represents the daily flights between cities of some airline. 6
Now find the minimum path from the city A to city E using BFS, where the each edge has
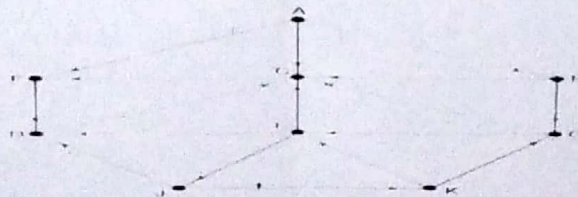length 1.

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.

Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science and Engineering
2nd Year 1st Semester B.Sc. Engineering Examination-2020

Course Code: CSE203   Course Title: Digital Logic Design
Total Marks: 60   Time: 3 (Three) Hours

N.B. i) Answer any **SIX** questions taking **THREE** from each section.

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   4
        whether B is 2's complement of A.
    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   8
        number using necessary MUXs with selectors S_1 and S_0.

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   6
        and one 2-to-1 multiplexer.
    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   5
        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.
    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   6
        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.
    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   4
        difference between Johnson Counter and Ring Counter?
    c) Write the difference between ROM and PLA.   2

Bangabandhu Sheikh Mujibur Rahman Science and Technology University

Department of Computer Science & Engineering

2nd Year 1st 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? 4

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Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science & Engineering
2nd Year 1st Semester B.Sc. Engineering Examination, 2020
Course Code: MAT205, Course Title: Vector, Matrix and Fourier Analysis

Time: 3 hours   **Full Marks: 60**

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

SECTION-A (30 Marks)

Q.1 (a) Define unit vector. Find a unit vector parallel to the resultant of vectors $r_1 = 2i + 4j - 5k$ 5
and $r_2 = i + 2j + 3k$

(b) Find the unit tangent vector to any point on the curve $x = t^2 + 1$, $y = 4t - 3$, $z = 2t^2 - 6t$.   5
Also determine the unit tangent at the point where $t = 2$.

Q.2 (a) Define gradient, divergence and curl. Find the directional derivative of $\phi = x^2 yz + 4xz^2$ 6
at $(1,-2,-1)$ in the direction $2i - j - 2k$.

(b) Prove that: $\nabla \times (\phi A) = (\nabla \phi) \times A + \phi(\nabla \times A)$ 4

Q.3 (a) Define line integrals, surface integrals and volume integrals.   6
Find the total work done in moving a particle in a force field given by
$F = 3xyi - 5zj + 10x\,k$ along the curve $x = t^2 + 1$, $y = 2t^2$, $z = t^3$ from $t = 1$ to $t = 2$.

(b) Evaluate $\iint_S A \cdot n\,dS$, where $A = zi + xj - 3y^2 zk$ and S is the surface of the cylinder   4
$x^2 + y^2 = 16$ included in the first octant between $z = 0$ and $z = 5$.

Q.4 (a) State and prove Green's theorem in the plane.   6

(b) Verify Green's theorem in the plane for $\oint_C (xy + y^2)dx + x^2 dy$ where C is the closed curve   4
of the region bounded by $y = x$ and $y = x^2$.

SECTION-B (30 Marks)

Q.5 (a) Define symmetric matrix, hermitian matrix and orthogonal matrix with example. Show   6
that $A = \begin{pmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{pmatrix}$ is a idempotent matrix.

(b) Show that, every square matrix can be uniquely expressed as the sum of a symmetric   4
matrix and a skew-symmetric matrix.

✓ Q.6 (a) Using row canonical form, find the inverse of the following matrix: 5

$$A = \begin{bmatrix} 3 & 4 & -1 \\ 1 & 0 & 3 \\ 2 & 5 & -4 \end{bmatrix}$$

(b) Define rank of a matrix.   5

Find the rank of the matrix $A = \begin{bmatrix} 1 & 3 & 1 & -2 & -3 \\ 1 & 4 & 3 & -1 & -4 \\ 2 & 3 & -4 & -7 & -3 \\ 3 & 8 & 1 & -7 & -8 \end{bmatrix}$.

✓ Q.7 (a) Define Fourier series.   5

Find the Fourier series of the function $f(x) = \begin{cases} 0, & -\pi \leq x \leq 0 \\ 1, & 0 \leq x \leq \pi \end{cases}$.

(b) Find the Fourier integral of the function $f(x) = e^{-kx}$ when $x > 0$ and $f(-x) = f(x)$ for   5

$k > 0$, and hence prove that $\int_0^\infty \frac{\cos ux}{k^2 + u^2} du = \frac{\pi}{2k} e^{-kx}$.

Q.8 (a) Find the Fourier transform of $f(x)$ defined by $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$.   4

(b) Use finite Fourier transforms to solve   6

$$\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}; \quad U(0,t) = 0 ; U(\pi,t) = 0 ; U(x,0) = 2x \quad \text{where } 0 < x < \pi, t > 0.$$

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Department of Computer Science and Engineering
2ⁿᵈ Year 1ˢᵗ Semester B.Sc. (Engg.) Final Examination-2020
Course Code: STA205, Course Title: Applied Statistics and Queuing Theory

Full Marks: 60   Time: 3 Hour

Section A
[Answer any **three** of following questions]

1. a) Define the following terms with example: Statistics, Variable, Data   3
    b) Distinguish among the following: Qualitative and quantitative variable, Bar   3
        diagram and histogram, Mean and median.
    c) Classify the following variables as nominal, ordinal, interval or ratio: 4
        Number of patients seen, Social Status, Quality of manufacturing product,
        Occupation, Country, Running Speed of an athletic.

2. a) Show that $\sum_{i=1}^{n}(x_i - \bar{x}) = 0$ 2
    b) Prove that arithmetic mean is dependent on both origin and scale of measurement.   3
    c) The following table shows the age distribution of 50 workers of a pharmaceutical   5
        company

Age in years	25-29	30-34	35-39	40-44	45-49	50-54
Number of workers	3	9	15	12	6	5

   Calculate mean and median.

3. a) What do you mean by dispersion? State the name of some measures of dispersion.   2
    b) The following table gives the marks of 30 students in physics in an examination   5

Marks	30-34	35-39	40-44	45-49	50-54
Number of students	8	12	6	2	2

   Calculate variance and hence standard deviation.
    c) Show that the variance is independent on the origin but dependent on the scale of   3
        measurement.

4. a) Define and illustrate with example: Probability, Sample space, Event, Experiment   4
    b) Distinguish between: Deterministic experiment and Random experiment.   2
    c) A newly married couple is planning to have two children and suppose that each   4
        child is equally likely to be a boy or a girl. Construct a sample space and find the
        probability that the couple will have i) two boys ii) one boy and one girl iii) at least
        one girl.

Section B
[Answer any **three** of the followings]

5. a) What is regression analysis? Mention some properties of correlation coefficient.   4
        What are the differences between regression and correlation analysis?

✓ b) A departmental store has the following statistic on sales (y) for a period of last one   6
year of 10 salesmen, who have varying years of sales experience (x).

Salesperson	1	2	3	4	5	6	7	8	9	10
Years of experience (x)	1	3	4	4	6	8	10	10	11	13
Sales (y)	80	97	92	102	103	111	119	123	117	136

    i)   Find the regression of y on x.
    ii)   Predict the annual sales volume of persons who have 12 and 15 years of sales experience.

6. a) Define: Joint probability, Conditional probability.   2

   b) Examination results of 150 students showed that 95 students passed mathematics,   4
75 students passed economics and 135 students passed at least one of the above
subjects. A student is selected at random. What is the probability that the student
    i)   Passed both mathematics and economics?
    ii)   Failed both the subjects?
    iii)   Passed mathematics but failed economics?

   c) What is independence of events? A fire brigade has two fire engines operating   4
independently. The probability that a specific fire engine is available when needed
is 0.99
    i)   What is the probability that an engine is available when needed?
    ii)   What is the probability that none is available when needed?

✗7. a) Define probability distribution. What conditions to be satisfied for a probability   6
mass function? An unbiased coin is tossed three times. Let X be the number of
heads obtained as a result of the outcomes of this experiment. Find the probability
distribution of X.

   b) A continuous random variable X has the following density function: 4

$$f(x) = \frac{2(x+1)}{27}, 2 < x < 5$$
$$= 0, elsewhere$$

Find (i) $P(X < 4)$ and (ii) $P(3 < X < 4)$

$\frac{0}{.1 \times 10^{-9}}$
61
0.0004
$0.0001 \cdot \frac{}{10500}$

✗8. a) What is the differences between Bernoulli and Binomial distribution? State the   3
important properties of Binomial distribution.

   b) Find mean and variances of Binomial distribution.   4

   c) A traffic control officer reports that 75% of the trucks passing through a check post   3
are from within Dhaka city. What is the probability that at least three of the next
five cars are from outside of Dhaka city?

0.
.0001

5128