

**Institute of Information Technology, University of Dhaka**  
**Bachelor of Science in Software Engineering**  
**First Year First Semester Final Examination, 2023**  
**MATH 1107: Calculus I**

**Marks: 60**

**Time: 3 Hours**

**Professionalism**

**Excellence**

**Respect**

Answer any FIVE(5) including Question 3 of the following questions.

1. (a) Define removable discontinuity and infinite limit of a function with example. Identify the cases of non-differentiability of a function  $y = f(x)$ . [4]

(b) Find  $\lim_{x \rightarrow 0} (1 + \sin 2x)^{1/x}$  [4]

(c) A right circular cylinder is inscribed in a cone with height  $h$  and base radius  $r$ . Find the largest possible volume of such a cylinder. [4]

3. (a) State the Rolle's theorem. Show that the given function  $f(x) = 4x^2 - 20x + 29$  satisfies the hypotheses of Rolle's theorem on the interval  $[1, 4]$  and find all real number  $c$  in  $(1, 4)$  that satisfy the Rolle's theorem. [4]

(b) Given  $f(x) = \frac{x^2}{x^2-1}$  and its  $f'(x) = \frac{-2x}{(x^2-1)^2}$ ,  $f''(x) = \frac{(6x^2+2)}{(x^2-1)^3}$ . Find the following information and sketch  $f(x)$ : Domain; Even/Odd/Neither; x and y intercepts (if any); Horizontal/Vertical asymptotes (if any); Critical numbers; Intervals where Increasing/Decreasing; Relative Extrema; Inflection points (if any) and Concavity. [8]

3. (a) (i) Find  $\frac{dy}{dx}$  of  $\sqrt{xy} + e^y = \pi^2$  (ii) Find  $\frac{d^2y}{dx^2}$  of  $y = \sin 2x \cos 3x$  [2x 2]

(b) A 10 foot ladder is resting against the wall whose bottom is initially 6 feet away from the wall and is being pushed towards the wall at a rate of  $\frac{1}{2}$  ft/sec. How fast is the top of the ladder moving up the wall 8 seconds after you start pushing? [4]

(c) The radius of a sphere is measured to be 50 in. with a possible measurement error of  $\pm 0.02$  in. Estimate the possible error in the computed volume of the sphere. [4]

4. (a) Find the absolute extrema of  $f(x) = 3x^{5/3} - 15x^{2/3}$  on  $[-1, 3]$  [4]

(b) Evaluate (i)  $\int \frac{dx}{x^2\sqrt{4x^2-9}}$ , (ii)  $\int \tan^2 x \sec x dx$ . [2x 2]

(c) A particle is moving along a coordinate line at time  $t = 0$  is at a position 3 cm from the origin and travelling at a velocity of 7 cm/sec. If the acceleration of the particle is given by  $a(t) = 2 - 2(t+1)^{-3}$ , find the velocity and the position of the particle as functions of  $t$ . [4]

5. (a) Find the area of the region outside of the cardioid  $r = 2 - 2\cos\theta$  and inside the circle  $r = 4$ . [6]

(b) Find the area of the surface generated by revolving the curve  $x = \sqrt{9 - y^2}$ ,  $-3 \leq y \leq 2$  about the  $y$ -axis. [6]

a) Using cylindrical shells to find the volume of the solid generated when the region bounded by the graphs of  $x = y^2$  and  $y = x^2$  is revolved about  $y$ -axis. [6]

(b) Find the arc length of the curve  $24xy = y^4 + 48$  from  $y = 2$  to  $y = 4$ . [6]

7. (a) Find the solution of the following system by using row reduced-echelon form technique: [6]

$$\begin{aligned} x - y + 2z &= 5, \\ 2x + y - z &= 2, \\ 2x - y - z &= 4. \end{aligned}$$

(b) Determine whether the set of vectors  $\{(1, 0, 1), (-3, 2, 6), (4, 5, -2)\}$  in  $\mathbb{R}^3$  is linearly dependent. [6]

**Bachelor of Science in Software Engineering (BSSE)**  
**Stat 1103 : Probability and Statistics for Engineers I**  
**1<sup>st</sup> Year 1<sup>st</sup> Semester Final Examination, 2023**  
**Institute of Information Technology (IIT)**  
**Total Marks : 60**      **Time Allowed : 3 Hours**

**Answer Any FIVE Questions. Marks are given in right margin.**

- (a) What are the different approaches to summarizing data? Define frequency, relative frequency, and cumulative relative frequency and its uses in descriptive statistics. [3]

- (b) In what situation is the median preferable over the mean as a measure of central tendency? [4]  
What is the advantage of standard deviation over variance as a measure of spread?

- (c) Calculate the mean, median, first quartile, third quartile, and mode of the following data [5] on the lifetime (in days) of transistors:

$$130, 125, 124, 118, 117, 128, 121, 111, 126, 110, \\ 126, 126, 114, 117, 111, 112, 124, 122, 113, 114$$

2. (a) What is a random variable? Define discrete and continuous random variables with appropriate examples. [3]

- (b) Define probability mass and density functions. [3]
- (c) The joint density function of  $X$  and  $Y$  is given by [6]

$$f(x, y) = \frac{6}{7} \left( x^2 + \frac{xy}{2} \right), \quad 0 < x < 1, \quad 0 < y < 2.$$

Compute the density functions of  $X$  and  $Y$ . Are  $X$  and  $Y$  independent? Obtain the expected value of  $X$ .

3. (a) Obtain the expression of the expected value and cumulative distribution function of a [4] random variable that follows an exponential distribution with parameter  $\lambda$ .

- (b) Explain the memoryless property of an exponential distribution. [3]

- (c) The number of years radio functions follows an exponential distribution with parameter [5]  $\lambda = 1/8$ . (i) If John buys a new radio, what is the probability that the radio will function after ten years? (ii) If John buys a used radio, what is the probability that it will work after an additional ten years?

4. (a) What is sampling distribution? What are the differences between a t and standard normal [4] distribution?

- (b) The lifetime of a particular electrical part is a random variable with a mean of 100 hours [4] and a standard deviation of 10 hours. If 16 such parts are tested, find the probability that the sample mean is (i) less than 104 and (ii) between 98 and 104 hours.

- (c) Each computer chip made in a particular plant will, independently, be defective with a [4] probability of 0.25. If a sample of 1000 chips is tested, what is the approximate probability that fewer than 200 chips will be defective?

**Institute of Information Technology (IIT)**  
**University of Dhaka**  
**Bachelor of Science in Software Engineering**  
**1<sup>st</sup> Year 1<sup>st</sup> Semester Final Examination-2023**  
**GE 1105: Introduction to Sociology**

Marks-60

Duration-03 Hours

[Answer any five of the following questions. All questions carry equal marks]

1. State the nature of sociology as a subject of social science. Discuss the importance of studying sociology as a student of IIT. 12
2. What is the law of three stages in Sociology? Describe the types of suicide according to the theory of suicide given by Emile Durkheim. 12
3. Define social research with its objectives. Discuss the steps to be followed in conducting any social research.
4. Define family as a social institution. Discuss various factors affecting the family structure and the changing role of family in Bangladesh. 12
5. What does social stratification mean? Discuss major characteristics and types of social stratification. 12
6. Identify the reasons for the increasing trend of drug addiction among the youth in Bangladesh. Give your suggestions to prevent drug addiction. 12
7. Give an idea about different types of globalization. Discuss the advantages and disadvantages that a developing country like Bangladesh experiences as a result of globalization. 12



Institute of Information Technology

University of Dhaka

Bachelor of Science in Software Engineering (BSSE)

1<sup>st</sup> Year 1<sup>st</sup> Semester Final Examination, 2023

SE 1106: Introduction to Software Engineering

Marks: 60 # Duration: 3 hours



Professionalism

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[Answer any 5 (five) questions. When answering a question, please answer all the subsections of it at once]

- a) What is software and Software engineering? Write the name of ten useful software. What are the basic differences between computer science and information technology? 6
- b) Write down the names of different models used in Software Engineering and explain the details of the linear sequential model with necessary diagrams. 6
2. a) Identify the appropriate process models for the following software projects and justify their appropriateness. 8
- i. A short class project called calculator where all the requirements are clearly defined
  - ii. A file management software that your company will publish in multiple releases
  - iii. A large-scale enterprise management software where the budget is flexible
  - iv. A medium-scale transaction management project which you would require to rapidly develop and demonstrate to your clients multiple times to gain a clear understanding of the requirements
- b) Write down the weaknesses of the waterfall model. Explain an example of a project where you would not use the waterfall model. 4
3. a) What is software measurement? Write and explain the different types of software measurement. 6
- b) Write the names of different metrics used in software engineering. Explain the Function Oriented metrics in detail. 6
4. a) What are the different software team and their activities in a particular scenario, where people will be working for k years and performing different functional tasks? 6
- b) Explain in detail the coordination and communications issues involved in software engineering. 6
5. a) Define Software Project Management. Write the ten causes which may affect the success of a project. 6
- b) Describe the common approaches for developing a software project. 6
6. a) Explain different types of Software Quality with examples. 6
- b) Write short notes on (i) Quality assurance (ii) Quality control (iii) Cost of quality 6
- . a) Define software testing. What are its objectives? Explain. 6
- b) Describe details of the testing principles. 6



**Institute of Information Technology**  
**University of Dhaka**  
**Bachelor of Science in Software Engineering (BSSE)**  
**1<sup>st</sup> Semester Final Examination, 2023**  
**CSE 1102: Discrete Mathematics**



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**Full Marks: 60**

**Duration: 3 hours**

Answer any 5 out of 7 questions.

1. a) Use rules of inference to show that the hypotheses "*If it does not rain or if it is not foggy, then the cricket final will be held,*" "*If the cricket final is held, then the trophy will be awarded,*" and "*The trophy was not awarded*" imply the conclusion "*It rained.*"
- b) For each English sentence below, write the first-order logic sentence that best expresses its intended meaning. Use *Person(x)* for "*x is a person*", *Food(x)* for "*x is food*", and *Likes(x, y)* for "*x likes y*". 3
- "For every food, there is a person who likes that food."
  - "There is a food that every person likes."
  - "For every person, there is a food that the person likes."
- c) Prove that  $m^2 = n^2$  if and only if  $m = n$  or  $m = -n$ . 3
- d) Give an explicit formula for a function from the set of integers to the set of positive integers that is 2
- one-to-one, but not onto.
  - onto, but not one-to-one.
  - one-to-one and onto.
  - neither one-to-one nor onto.
2. a) Let *C(x, y)* mean that "*student x is enrolled in course y*", where the domain for *x* consists of all students in your university and the domain for *y* consists of all courses being given at your university. Express each of these statements by a simple English sentence. 3
- $\exists x(C(x, \text{Math 222}) \wedge C(x, \text{CS 252}))$
  - $\exists x \exists y \forall z((x \neq y) \wedge (C(x, z) \rightarrow C(y, z)))$
  - $\forall x \forall z \exists y((x \neq z) \rightarrow \neg (C(x, y) \wedge C(z, y)))$
- b) Use induction to prove that  $3 + 3 \cdot 5 + 3 \cdot 5^2 + \dots + 3 \cdot 5^n = 3(5^{n+1} - 1)/4$  whenever *n* is a nonnegative integer. 3
- c) Use strong induction to show that if you can run one mile or two miles, and if you can always run two more miles once you have run a specified number of miles, then you can run any number of miles. 3
- d) Determine the truth value of each of these statements if the domain of each variable consists of all real numbers. 3
- $\exists x(x^2 = 2)$
  - $\exists x(x^2 = -1)$
  - $\forall x(x^2 + 2 \geq 1)$
  - $\exists x(x^4 < x^2)$
  - $\forall x((-x)^2 = x^2)$
  - $\forall x(2x > x)$



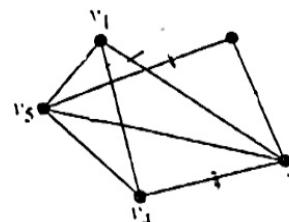
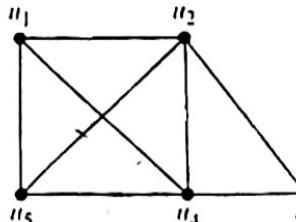
3. a) Use Huffman coding to encode these symbols with given frequencies:  $a: 0.20$ ,  $b: 0.10$ ,  $c: 0.15$ ,  $d: 0.25$ ,  $e: 0.30$ . What is the average number of bits required to encode a character? 6

- b) Devise a recursive algorithm for computing  $b^n \bmod m$ , where  $b$ ,  $n$ , and  $m$  are integers with  $m \geq 2$ ,  $n \geq 0$ , and  $1 \leq b < m$ . 6

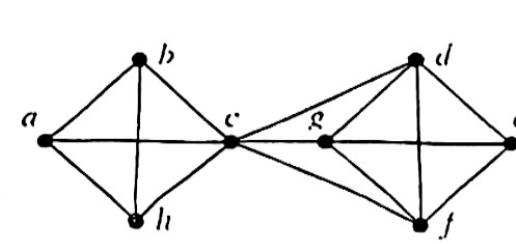
4. a) Determine whether the relation  $R$  on the set of all people is *reflexive*, *symmetric*, *antisymmetric*, and/or *transitive*, where  $(x, y) \in R$  if and only if

- $x$  is a parent of  $y$
- $x$  is a sibling of  $y$

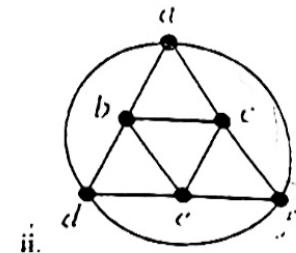
- b) Determine whether the given pair of graphs is isomorphic. Exhibit an isomorphism or provide a rigorous argument that none exists.



i) Find the vertex connectivity and edge connectivity of the following graphs:



i.



ii.

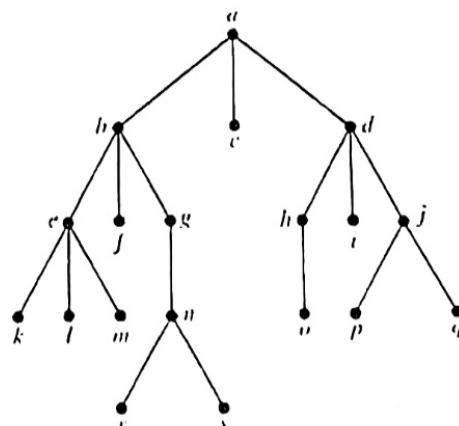
5. a) Find the smallest relation containing the relation  $\{(1, 2), (1, 4), (3, 3), (4, 1)\}$  that is

- reflexive and transitive.
- symmetric and transitive.
- reflexive, symmetric, and transitive.

3

- b) Build a binary search tree for the words *oenology*, *phrenology*, *campanology*, *ornithology*, *ichthyology*, *limnology*, *alchemy*, and *astrology* using alphabetical order. Show your steps.

- c) Determine both the **preorder** and **inorder** traversal order of nodes from the following tree: 4



- d) Give an example of a relation on a set that is

- both symmetric and antisymmetric.
- neither symmetric nor antisymmetric.

2

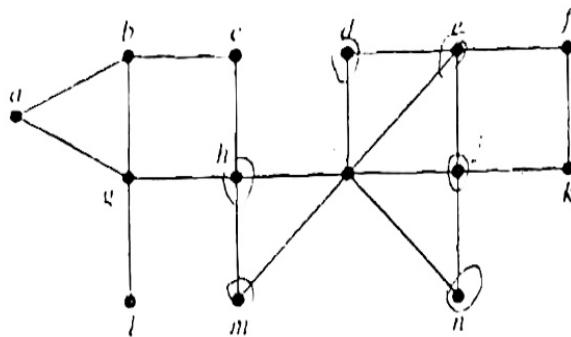
- a) During a month with 30 days, a cricket team plays at least one game a day, but no more than 45 games. Show that there must be a period of some number of consecutive days during which the team must play exactly 14 games.

3

- b) In a certain country, a license plate number must have 6 alphanumeric characters, where either the first two or three are uppercase English letters and the remaining are digits (for example, CM1984 and ZBM337 are valid license plate numbers). What is the total number of possible license numbers the country can have?

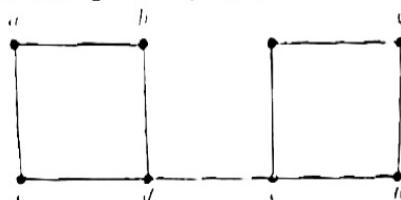
3

- c) Use breadth-first search, starting from the node  $i$ , to produce a spanning tree for the given graph.



2

- d) Draw all the spanning trees of the given simple graph.



7. a) How many solutions are there to the equation

$$x_1 + x_2 + x_3 + x_4 = 17,$$

where  $x_1, x_2, x_3$ , and  $x_4$  are nonnegative integers?

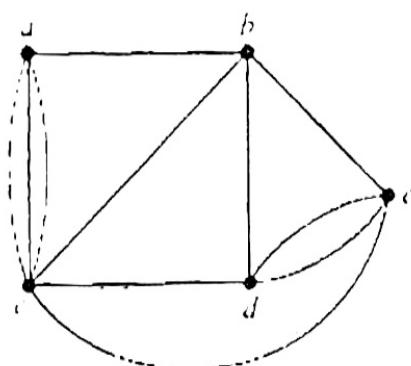
3

- b) Suppose that a large family has 14 children, including two sets of identical triplets, three sets of identical twins, and two individual children. How many ways are there to seat these children in a row of chairs if the identical triplets or twins cannot be distinguished from one another?

3

- c) Determine whether the given graph has an Euler circuit. Construct such a circuit when one exists. If no Euler circuit exists, determine whether the graph has an Euler path and construct such a path if one exists.

3



- d) What is a bipartite graph? Show an example. Mention two real-life applications where bipartite graphs can be used.

3



**University of Dhaka**  
**Institute of Information Technology**  
**Bachelor of Science in Software Engineering (BSSE)**  
**1<sup>st</sup> Semester Final Examination, 2023**  
**CSE 1101: Structured Programming**  
**Marks: 60 Time: 3 Hours**



**Professionalism      Excellence      Respect**

[Answer any 5 (five) questions. When answering a question, please answer all the subsections of it at once]

- |   |   |
|---|---|
| a. What are the essential components of a C program? Write an example code and show all the components.                                       | 4 |
| b. What is a variable? What are C's data type modifiers and what function do they perform? What does a typecast do?                           | 3 |
| c. How do we put comments in C? Why comments are important?   | 2 |
| d. What is a function? How many types of functions are there? How does a function return a value to the routine that called it?               | 3 |
| 2. a. What are C's relational and logical operators? Give one example code demonstrating all those operators.                                 | 3 |
| b. What is a block of code? How do you make one?  | 2 |
| c. Write short notes on C's increment and decrement operators.  | 2 |
| d. Write a program that displays all the prime factors of a number entered by the user. Print the output as the prime factor tree as follows: | 5 |

User input: 54

Output:

54  
2 27  
3 9  
3 3  
3 1

- |  |   |
|--|---|
| 3. a. What are the ways we perform loops in C? How they are different from each other?   | 3 |
| b. What are the ways we make decisions in C? How they are different from each other?   | 3 |
| c. What does a <i>break</i> statement do?  | 2 |
| d. Write a menu-driven program, where the user will be asked to perform which operation she wants to perform from the following functions: Addition, Subtraction, Multiplication, and Division. The program will continuously run until the user selects the Exit function. If any error occurs your program should also be able to inform that. | 4 |
| 4. a. int *a[10]; int (*b)[10]; Then what are a and b represents?  | 2 |
| b. Are the expressions <i>*ptr++</i> and <i>++*ptr</i> same? Explain.  | 2 |
| c. What will be the output of the following 'C' code?  | 2 |

```
int a = 0x11223344;
unsigned char *c = (unsigned char *) &a;
printf("%02X\n", *c);
```

- |  |   |
|--|---|
| d. What would be the equivalent pointer expression for referring to the same element as <i>a[p][q][r][s]</i> ?   | 3 |
| e. Write a program in C to find the sum and mean of all elements in an array using pointers.   | 3 |
| 5. a. What are the advantages of using pointers as parameters in a function? Give one example code.  | 3 |
| b. Write a program that takes an integer input and outputs the factorial of that number using recursion.   | 3 |
| c. What is command line arguments?   | 2 |
| d. Write a program that accepts two strings as command-line arguments. Have the program compare them and report which is lexicographically greater than the other. | 4 |
| 6. a. Find the errors in the following programs. Give a correct implementation of each of these functions.   |   |

- i) The *str\_cpy* function is to copy a valid C string to another. An (erroneous) implementation is given below:

```
unsigned int str_cpy (char *d, char *s) {
```

```
unsigned int i=0;
while (s != '\0') { *d = *s; s++; d++; i++; }
return i;
}
```

- ii) The str\_len function takes a valid C string as an argument and returns the length of the string. An (erroneous) implementation is given below:

```
unsigned int str_len(const char *s) {
    unsigned int i;
    while (s[i] >= 0) i++;
    return i;
}
```

- b. How do functions like printf() and scanf() relate to the C file system? 2
- c. Write a program that takes a location value from the command line and shows the character at that location in the file. 2
7. a. What is bit-field? Write a structure where you can put a student's roll, batch, and semester information in a single integer. 2
- b. What are the differences between structure, union and array? 3
- c. Write a program that displays the ASCII code when a key is pressed. 3
- d. Take a file, from the command line, containing the user ID and password (four bytes long). Since you have to store it securely, encode passwords by swapping each of the password's upper two bytes with the lower two bytes. When the user enters her user ID and password, you have to check the file and mention whether the user ID and password are right or wrong. 7