

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computer Science & Engineering

FIRST MID SEMESTER EXAMINATION - SEPTEMBER, 2023

COURSE TITLE: CSE311 Artificial Intelligence

Time: 09:30 -11:00 AM

Date: 01.09.2023

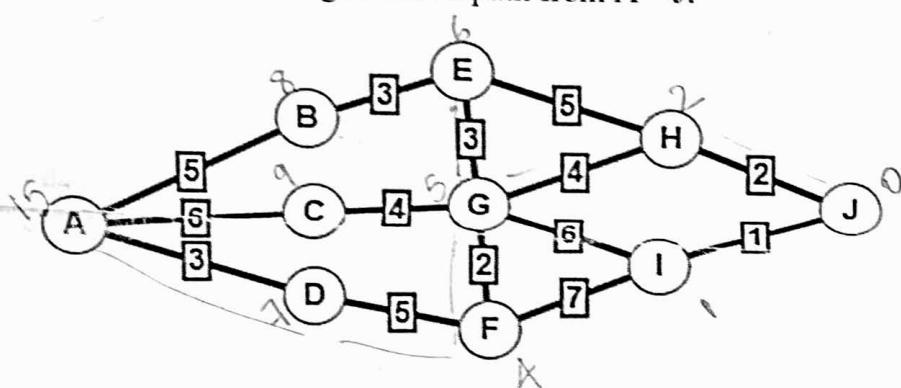
Max. Marks: 50

Course Instructors: Dr. Victer Paul / Dr. Sivaiah Bellamkonda

Batch: 1 & 2

Answer all Questions

1. Present the steps of the UCS algorithm. Trace the algorithm and present the state space tree for the following to find a path from A→J: 10M



~~37 3+2+4+2
240~~

2. Present the working of A* algorithm. Trace the algorithm and present the state space tree for the graph in question number 1 to find a path from A→J, given the following heuristic h(n): 10M

Node - n	A	B	C	D	E	F	G	H	I	J
h(n)	15	8	9	7	6	4	5	2	1	0

3. As a competitor to Tesla, you are expected to create a learning agent based self-driving car. Design a model for the agent program and demonstrate the responsibilities of the components in the model. 10M

4.

- a. A company recruits a team of programmers to develop an AI agent to solve the 8-queens problem efficiently. Assume that you are an AI system designer and develop the problem definition for the specified problem. 5M
- b. A system engineer wanted to use the best uninformed search algorithm for his optimization model. Help him by describing the set of parameters that can be used to evaluate the performance of search strategies and also compare different uninformed search algorithms using the parameters. 5M
- c. Consider the famous robot competition, Robot J-League, in which a team of soccer playing robots compete against the other to win the match. You are expected to specify the task environment for the robots and also classify the game environment based on its different properties. 10M



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computer Science & Engineering
SECOND MID SEMESTER EXAMINATION - OCTOBER 2023

COURSE TITLE: CSE311 Artificial Intelligence

Time: 09:30 -11:00 AM

Date: 05.10.2023

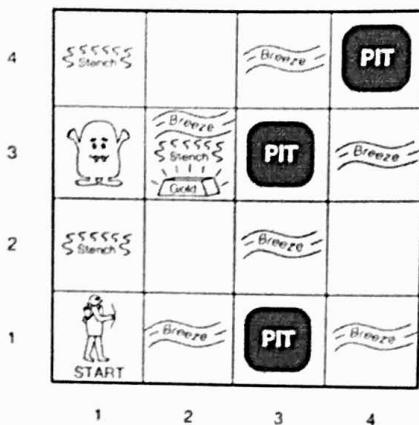
Max. Marks: 50

Course Instructors: Dr. Victer Paul / Dr. Sivaiah Bellamkonda

Batch: 1 & 2

Answer all Questions

1. Use Propositional logic concepts to solve the wumpus world problem given:



- a) Create atomic prepositions 1M
- b) Prepare knowledge base 2M
- c) Specify the inference rules required 2M
- d) Deduce and Prove "There is a Pit in the box [3,1]" 5M

2. Given the following facts:

- ✓ Ram is a robber
- ✓ Raju is a pickpocket
- ✓ A thief is someone who is either robber or a pickpocket
- ✓ Ravi is an Inspector
- ✓ Inspectors hate thieves
- ✓ Thieves like one other
- ✓ Thieves fear of Inspector
- ✓ Inspector shoots thieves

- a) Represent these English sentences in FOL. 2M
- b) Symbolize the same as Prolog Facts and Rules. 2M
- c) Write prolog queries and infer the result for the given questions with expected result:
 - 1) Who likes Raju? 2M
 - 2) Who fears Inspector? 2M
 - 3) Who Inspectors shoots? 2M

3/ Given two fuzzy sets

$$X = \{(0.05/2.0), (0.23/2.5), (0.67/3.0), (0.25/3.5), (0.51/4.0), (1.0/5.0)\},$$

$$Y = \{(0.02/2.0), (1.0/2.5), (0.5/3.0), (0.25/3.5), (0.76/4.0), (0.9/5.0)\},$$

- a) Find the complement of Y. 2M
- b) Find $X \cup Y$. 2M
- c) Find $X \cap Y$. 2M
- d) Prove commutative law holds on fuzzy sets using X and Y. 2M
- e) Prove demorgan's law holds on fuzzy sets using X and Y. 2M

4.

- a) What is a membership function and how many shapes can it be defined? 2M
- b) How to determine the degree of membership value of a triangular membership function? 2M
- c) How to determine the degree of membership value of a trapezoidal membership function? 2M
- d) What is the degree of membership value of element $x=44$ in a set defined by $[0, 50, 100]$? 2M
- e) What is the degree of membership value of element $x=12$ in a very tall set provided the tall set defined by $[0, 20, 60, 100]$? 2M

5. Consider a use case of project risk estimation given project funding and project staffing with the following rules:

Rule: 1 - IF project_funding is adequate OR project_staffing is small THEN risk is low

Rule: 2 - IF project_funding is marginal AND project_staffing is large THEN risk is normal

Rule: 3 - IF project_funding is inadequate THEN risk is high

Assume fuzzy sets are defined as **inadequate** = {0,0,20,50}, **marginal** = {30,50,75}, **adequate** = {60,75,100,100}, **small** = {0,0,15,65}, **large** = {35,70,100,100}, **low** = {0,0,25,35}, **normal** = {30,45,55,65} and **high** = {60,75,100,100}.

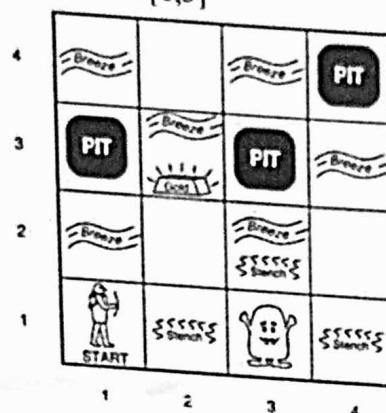
- a) List fuzzy variables and sets of the problem. 1M
- b) Given the crisp inputs: project_funding 50% and project_staffing 50%, show the degree of membership values after fuzzification. 2M
- c) Evaluate the three rules and show the fuzzy output of each rule. 3M
- d) Perform aggregation of rule outputs and show the resultant fuzzy set. 2M
- e) Use CoG method to perform defuzzification and show the crisp output. 2M

Date & Time: 15.11.2023 & 09:30AM -12:30PM

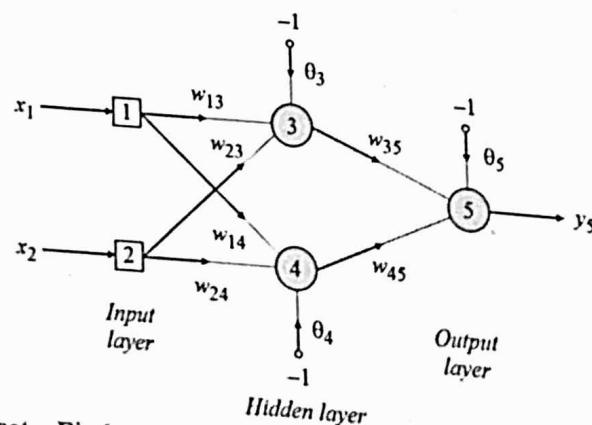
Course Instructor: Dr. Victer Paul & Dr. Sivaiah Bellamkonda

Answer all Questions

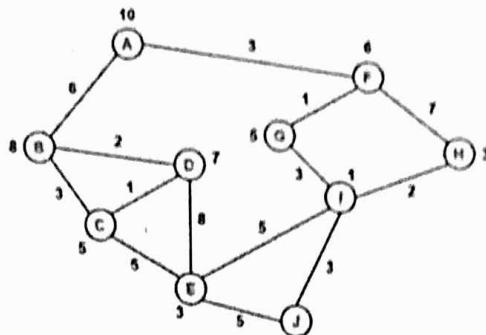
- ✓ 1. A) With suitable example demonstrate the different kinds of Agent Environments. 5M
B) Discuss various state representation models. 5M
2. Use Propositional logic concepts to solve the problem given. Prepare knowledge base, deduce and prove "There is a Wumpus in the box [1,3]" 10M



- ✓ 3. Assume the values given below, perform manual workout of the backpropagation algorithm for Multi-Layer Perceptron and identify the modified weight and threshold values at the end of the iteration. 15M
 $x_1 = 1, x_2 = 1, y_5 = 0, w_{13} = 0.5, w_{14} = 0.9, w_{23} = 0.4, w_{24} = 1.0, w_{35} = -1.2, w_{45} = 1.1, \theta_3 = 0.8,$
 $\theta_4 = -0.1$ and $\theta_5 = 0.3$



- ✓ 4. A) Given two fuzzy sets, Find the complement of A, $A \cup B$, $A \cap B$.
 $A = \{(0/165), (0/175), (0/180), (0.25/182.5), (0.5/185), (1/195)\},$
 $B = \{(0/165), (1/175), (0.5/180), (0.25/182.5), (0/185), (0/195)\},$ 5M
- B) Assume 'Sambar' is a member of a fuzzy set 'tasty' dish with a value 0.65. Calculate the membership value for the fuzzy sets: 'indeed tasty', 'more or less tasty', 'very tasty'. 5M
- ✓ 5. A) Consider the graph below to trace DFS and BFS algorithms. Justify which is better in solving AI problems. (Note: Start at node 'A') 5M
B) Trace A* algorithm for the following graph, where numbers attached to nodes are heuristic value: (in next page) 10M



6. Given the following English sentences:

Venkat eats veg-food. Prabhu eats non-veg-food. Lakshmi likes who eats biryani. Biryani is non-veg-food. Sambar is veg-food. Priya likes who eats veg-food.

10M

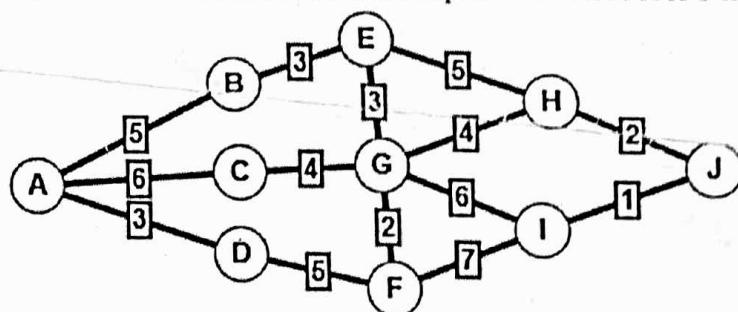
- A) Convert to Prolog facts and rules.
- B) Write rules required to answer the questions.
- C) Write query and output to answer 'Who eats Biryani?'
- D) Write query and output to answer 'Who eats Sambar?'
- E) Write query and output to answer 'Whom does Priya likes?'
- F) Write query and output to answer 'Whom does Lakshmi likes?'

7. A) Discuss the characteristics of intelligent systems.

5M

- B) Present the working of greedy breadth first search and find the path from node A to J from the following graph:

10M



8. Consider a use case of project risk estimation given project funding and project staffing with the following rules:

(15)

Rule: 1 - IF project_funding is adequate OR project_staffing is small
THEN risk is low

Rule: 2 - IF project_funding is marginal AND project_staffing is large
THEN risk is normal

Rule: 3 - IF project_funding is inadequate THEN risk is high

Assume fuzzy sets are defined as **inadequate** = {0,0,30,60}, **marginal** = {30,60,70}, **adequate** = {60,70,100,100}, **small** = {0,0,20,60}, **large** = {30,70,100,100}, **low** = {0,0,20,30}, **normal** = {30,40,50,60} and **high** = {50,60,100,100}

- A) List fuzzy variables and sets of the problem.
- B) Given the crisp inputs: project_funding 55% and project_staffing 70%, show the degree of membership values after fuzzification.
- C) Evaluate the three rules and show the fuzzy output of each rule.
- D) Perform aggregation of rule outputs and show the resultant fuzzy set.
- E) Use CoG method to perform defuzzification and show the crisp output.



Batch I & II

Time: 09:30-11:00 AM

Course Instructors: John and Balasubramanian

Semester V

Max marks: 50

Answer all questions

The act of exchanging calculators during the exam is strictly prohibited.

- Q1. (a) Suppose that a computer program takes 100 seconds of execution time on a computer with multiplication operation responsible for 80 seconds of this time. How much do you have to improve the speed of the multiplication operation if you are asked to execute this program four times faster? (5)
- (b) Write the OpenMP program with C/C++ with the desired output for the following problem. A prime number is a positive integer evenly divisible by exactly two positive integers: itself and 1. Take first five prime numbers are 2, 3, 5, 7, and 11. Sometimes two consecutive odd numbers are both prime. For example, the odd integers following 3, 5, and 11 are all prime numbers. However, the odd integer following 7 is not a prime number. Write a parallel program to determine, for all integers less than 100, the number of times that two consecutive odd integers are both prime. (5)
2. What is the total execution time required for a program comprising 12 instructions (I1, I2, ..., I12) in a pipelined processor with five stages, namely Instruction Fetch (IF), Instruction Decode (ID), Operand Fetch (OF), Execute (EX), and Operand Write (OW)? The delays for the IF, ID, OF, EX, and OW phases are 5 nsec, 7 nsec, 12 nsec, 8 nsec, and 6 nsec, correspondingly. Each stage is followed by an intermediate storage buffer with a delay of 3 nsec. It's important to note that instruction I4 serves as the sole branch instruction, with its branch target directed to instruction I10. In case the branch is taken during the program's execution, what would be the time required for the program's completion? It is necessary to illustrate with neat time phase diagram. (10)
3. Explain Flynn's classification of parallel processing system with neat diagrams. (10)
4. The value of the definite integral $\int_a^b f(x) dx$, where $f(x) = \frac{4}{1+x^2}$ is π (3.1415 or 22/7). We can use numerical integration to compute π by approximating the area under the curve. A simple way to do this is called the rectangle rule (An example is provided in Figure 1).

~~(5+12^-1)~~
~~(5+10^-1)~~

Please turn over...

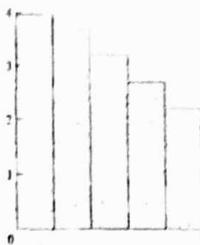


Figure 1: The rectangle rule is a simple way to approximate the area under a curve. In this example the function is $\frac{4}{1+x^2}$, and the area under the curve between 0 and 1 is π .

- (a) Write the serial version program with C/C++ to estimate the value of pi (π). (3)
- (b) Write a parallel program using OpenMP with C/ C++ to compute π using the rectangle rule with 100 intervals. You have to show the output with the number of threads involved and the area calculated by which thread (number). (5)
- (c) Identify the line of statement which leads the race condition? If it exists how will you handle this problem? Use all the appropriate OpenMP synchronization clauses and compare different proposed solutions. (5)

5. Consider the following bit of code

```

1 #include <stdio.h>
2 #include <stdlib.h>
3 #include <omp.h>
4
5
6 int main(void){
7     int i;
8     int x;
9     x=44;
10 #pragma omp parallel for private(x)
11 for(i=0;i<=10;i++){
12     x=i;
13     printf("Thread number: %d      x: %d\n",omp_get_thread_num(),x);
14 }
15 printf("x is %d\n", x);
16
17
18 }
```

1: Code Snippet

- (a) Trace the output with proper justification. (3)
- (b) Modify the code in order to keep the last value of x after the parallel region. Trace the output with proper justification (4)

Batch I & II

Time: 09:30-11:00 AM

Course Instructors: John and Balasubramanian

Semester V

Max marks: 50

Answer all questions

The act of exchanging calculators during the exam is strictly prohibited.

1. (a) How exploratory decomposition differs from speculative decomposition techniques. (5)

- (b) Solve 'Tic Tac Toe' game using exploratory decomposition detail with neat diagrams. (5)

Note: Tic Tac Toe is a game for two players to position their marks so that they make a continuous line of three cells vertically, horizontally, or diagonally on a 3x3 grid. Consider Initial position as shown in Figure 2 and you may assume that X initiated the game (first step made on the board).

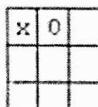


Figure 1: Tic Tac Toe- Initial Position

2. Consider a summer sales promotion database with information about their orders

Date	Product	Quantity	Price	Promotion
2019-06-01	Smartphone case	11	\$119.70	1 Free with 10
2019-06-01	HDMI cable	6	\$77.82	Extra Discount
2019-06-01	USB car charger	15	\$100.95	Extra Discount
2019-06-01	HDMI cable	11	\$149.71	1 Free with 10
2019-06-02	USB car charger	22	\$155.40	1 Free with 10
2019-06-02	USB car charger	3	\$20.19	Extra Discount
2019-06-02	Earbuds	5	\$33.65	Extra Discount
2019-06-02	Smartphone case	22	\$239.36	1 Free with 10
2019-06-02	HDMI cable	10	\$129.70	Extra Discount
2019-06-05	USB car charger	22	\$155.40	1 Free with 10

Figure 2: Summer sales promotion database

- (a) Compute the following query to get a desired result Query: Date= "2019-06-02" AND Product= "USB'charger" AND (Quantity >= "3" OR Promotion= "Extra Discount"). Draw any two ways of task dependency graph and compute the average degree of concurrency. (10)
- (b) Explain Output and Input data decomposition with respect to the table and identify the suitable decomposition approach, detail it with proper justification for the selection. (5)

Please turn over...

3. (a) Write an OpenMP program with C/C++ that solves the system of linear equations $Ax = b$ using Gaussian elimination with row pivoting, followed by backward substitution. (4)

By Test case to check the output (1)

$$2x_1 + x_2 + x_3 = -3$$

$$4x_1 + 4x_2 + 3x_3 = -3$$

$$8x_1 + 10x_2 + 13x_3 = -45$$

4. Write an MPI program with C that the value of the token is passed by all processes in a ring-like fashion as in Figure 3. In this setup, P0 is the root process and it contains token's value as 100. The token value is passed around every single process. The program terminates when the root process (P0) receives the token's value from the last process (P3).

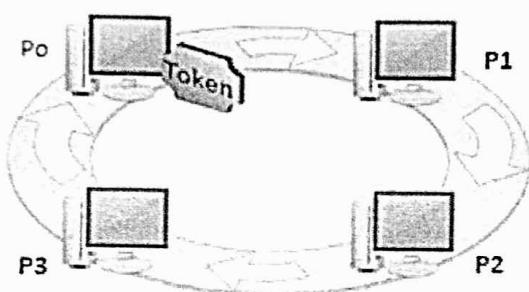


Figure 3: Schematic diagram-Ring Fashion

- (a)* Considering the given scenario, write the MPI program using C programming language with appropriate processes and MPI built-in functions, also explain your logic in detail . (6)
- (b) Write the desired output of the program. (1)
- (c) Is this program affected with deadlock? Justify your answer. (3)
5. Write a MPI program that estimates the value of pi (π) using trapezoidal rule for numerical integration. (2)
- (a) Illustrate the mathematical formula for trapezoidal rule for the following function. (Derivation is not required)
- Area = $\int_a^b f(x) dx$, where $f(x) = \frac{4}{1+x^2}$, Where a=0, b=3, n=512
- (b) Write the MPI code for parallel program with MPI built-in functions to estimate the value of pi (π). Root process is collecting the results from the other processes and produces the final output. (7)
- Assume: Number of processes=4, Root process=MAX(Rank of the processes)
- (c) Write the desired output as per the program I/O statements. (1)



END SEMESTER EXAMINATION - NOVEMBER, 2023

COURSE TITLE: ICS 311 - Parallel and Distributed Computing

Time: 24-11-2023 [9.30 a.m. - 12.30 p.m.]

Max. Marks: 100

Course Instructors: Johnpaul Martin & P. Balasubramanian

Sem.: V

Batch: I & II

Answer all Questions

1. Write short notes on the following:

(a) Examine the fundamental distinctions between **parallel computing** and **distributed computing**. Discuss how these differences impact scalability, fault tolerance, and the efficient utilization of resources in the context of large-scale computational tasks. [5 M]

(b) Explore the key challenges and complexities associated with parallel computing. Investigate how these challenges manifest across various parallel architectures and programming models, considering both shared-memory and distributed-memory systems. [5 M]

2. Data decomposition is a crucial aspect of parallel computing, enabling the efficient distribution of computational tasks across multiple processors. Explore the various data decomposition techniques considering **matrix multiplication** problem. [10 M]

3. You are tasked with optimizing a scientific simulation program used for weather forecasting. The simulation consists of four major components: initialization (Part A), computation (Part B), communication (Part C), and output generation (Part D). After careful analysis, it is determined that Part B is the most time-consuming and can be parallelized. The original execution time breakdown is as follows: Part A (15%), Part B (50%), Part C (20%), and Part D (15%). After parallelization, Part B achieves a speedup of 6. Calculate the **overall speedup**, the **parallel fraction**, and the **efficiency** of the optimized program assuming an infinite number of processors. [10 M]

4. An instruction pipeline has **five stages** where each stage takes **2 nanoseconds** and all instructions use all five stages. Branch instructions are not overlapped, i.e., the instruction after the branch is not fetched till the branch instruction is completed. Under ideal conditions.

(a) Calculate the average instruction execution time assuming that 20% of all instruction executed are branch instructions. Ignore the fact that some branch instructions may be conditional. [5 M]

(b) If a branch instruction is a conditional branch instruction, the branch need not be taken. If the branch is not taken, the following instructions can be overlapped. When 80% of all branch instructions are conditional branch instructions, and 50% of the conditional branch instructions are such that the branch is taken, calculate the average instruction execution time. [5 M]

5. (a) Write the OpenMP program that implements Prim's algorithm to find the Minimum Spanning Tree (MST) in a weighted undirected graph $G=(V, E)$ shown in Fig. 1, where V is the vertex set and E is the collection of edges in G . [10 M]

- (b) As per the algorithm in (a), show the necessary steps/iterations in arriving final MST of the graph G . Assume the start node is A. The graph G is represented as an adjacency matrix $m[i][j]$ that represents the weight of the edge from vertex i to vertex j . [5 M]

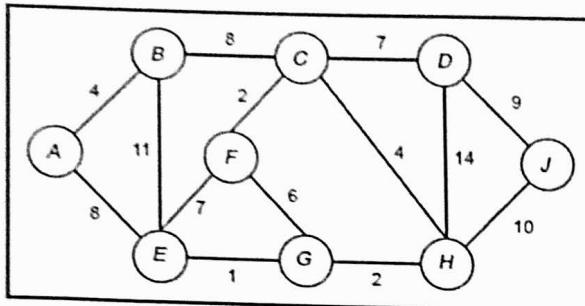


Fig. 1: Weighted undirected graph $G=(V, E)$

6. Consider the following doubly nested loop:

```

for (i=0; i<m; i++)
{
    low=a[i];
    high=b[i];
    if (low>high)
    {
        printf("Exiting during iteration %d\n", i);
        break;
    }
    for (j=low; j<high; j++)
        c[j] = (c[j]-a[i])/b[i];
}

```

- (a) Is it possible to parallelize the iterations of the outer for loop? Justify your answer with necessary explanation. If you found the reason, what will be the solution will be provided using OpenMP directives/clauses and justify why you have chosen? Write the code snippet for the same. [3 M]
- (b) Is it possible to parallelize the iterations of the inner for loop? Justify your answer with necessary explanation. If you found the reason, what will be the solution will be provided using OpenMP directives and justify why you have chosen? Write the code snippet for the same. [3 M]
- (c) We certainly don't want to see the error message more than once. Identify the OpenMP directive to solve this issue? Write the code snippet for the same. [3 M]
- (d) How to improve the performance of the modified version of the program (after the changes done with respect to (a), (b) and (c)). Hint: Identify the code blocks (in the modified program) that facing the barrier synchronization. Write the code snippet for the same. [3 M]
- (e) Write the output of the modified program in (d) for the following test cases.

Case 1: Assume $m=5$, and the array variables $a[5]=\{10,20,30,40,50\}$, $b[5]=\{5,15,25,35,45\}$. Number of threads will be system dependent. [1.5 M]

Case 2: Assume $m=5$, and the array variables $a[5]=\{5,15,25,35,45\}$, $b[5]=\{10,20,30,40,50\}$. Number of threads will be system dependent. [1.5 M]

7. (a) How serial odd-even transposition sort is not cost optimal in terms of asymptotic run time? [2 M]
- (b) Write the cost optimal parallel formulation pseudocode/algorithm of odd even transposition sort. [2 M]
- (c) Write the necessary steps according to the algorithm in (a) to sort the elements 3, 2, 3, 8, 15, 11, 9, 16, 5, 6, 4, 1, 2, 14, 8, 7. [4 M]
- (d) Write the necessary steps according to the algorithm in (b) to sort the elements in (c). Assume, number of processes (p)=4. [3 M]
- (e) Derive the parallel run time of the same with respect to number of process (p) and number of elements (n). [3 M]
8. (a) Write a non-deadlock or safe state MPI Parallel Program that implements Cannon's Matrix Multiplication for multiplying two matrices A and B of size $n \times n$. Use MPI Cartesian topology for the physical execution plan with proper parameters setup. The result of the $A \times B$ is stored in another matrix C. [10 M]
- (b) Consider the following matrices A and B. Perform Matrix multiplication using Cannon's algorithm with detailed steps. [5 M]

A				B			
2	1	5	3	6	1	2	3
0	7	1	6	4	5	6	5
9	2	2	4	1	9	8	-8
3	6	7	2	4	0	-8	5

*** "Education is not the filling of a pail, but the lightening of a fire" - W. B. Yeats ***

**FIRST MID SEMESTER EXAMINATION- SEPTEMBER, 2023****IMA311: Soft Computing****Date & Time:** 02-09-2023, 02:30 PM - 04:00 PM**Course Instructor:** Suriyapriya K**Max mark:** 50**Batch:** 2021 CSE-1&2**Answer all Questions**

1. Consider the following two fuzzy sets:

$$A = \frac{0.1}{0} + \frac{0.2}{1} + \frac{0.3}{2} + \frac{0.7}{4} + \frac{0.9}{5}$$

$$B = \frac{0.5}{0} + \frac{0.85}{1} + \frac{0.99}{2} + \frac{0.78}{4} + \frac{0.09}{5}$$

Find the following:

- (a) $A \cup B$
- (b) $A \cap \overline{B}$
- (c) Support and height of A and B
- (d) $0.8A$
- (e) $0.78+B$

2. Three fuzzy sets are defined as follows:

$$A = \frac{0.1}{30} + \frac{0.2}{60} + \frac{0.4}{90} + \frac{0.7}{120}$$

$$B = \frac{1}{1} + \frac{0.25}{2} + \frac{0.35}{3} + \frac{0.48}{4} + \frac{0.7}{5} + \frac{0.9}{6}$$

$$C = \frac{0.89}{100} + \frac{0.62}{200} + \frac{0.97}{300} + \frac{0.21}{400}$$

Find the following:

- (a) $R = A \times B$
- (b) $S = B \times C$
- (c) $T = R \circ S$ using Max-min composition

3. A binary relation R from X to X is given by,

$$R = \frac{1}{(x_1, x_1)} + \frac{0.95}{(x_1, x_2)} + \frac{0.76}{(x_1, x_3)} + \frac{0.95}{(x_2, x_1)} + \frac{1}{(x_2, x_2)} + \frac{0.81}{(x_2, x_3)} + \frac{0.76}{(x_3, x_1)} + \frac{0.81}{(x_3, x_2)} + \frac{1}{(x_3, x_3)}.$$

Determine whether the relation R is an equivalence relation or a tolerance relation. Justify.
Also, find Domain of R , Range of R and Height of R

4. Consider the fuzzy numbers

$$A = \frac{0.2}{-2} + \frac{1}{-1} + \frac{0.7}{1}$$

$$B = \frac{0.7}{1} + \frac{0.8}{2} + \frac{1}{3}$$

Compute $A + B$, $A - B$, $A \cdot B$, $\left(\frac{A}{B}\right)$ using the extension principle.

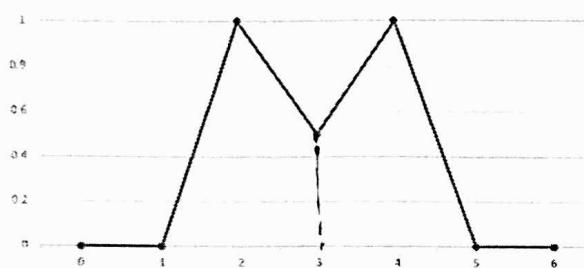
P.T.O

5. Suppose 1000 people respond to a questionnaire about their pairwise preferences among five works, X=Software(S), Hardware(H), Teaching(T), Business(B), Textile(TX). From the given table, use rank ordering method to plot the membership function for the "most preferred work". Also represent the obtained fuzzy set graphically. [6]

	S	H	T	B	TX
S	-	82	65	55	25
H	70	-	52	66	35
T	62	48	-	38	25
B	52	57	35	-	20
TX	70	65	44	34	-

6. For the given fuzzy set

[10]



Find the defuzzified value using

- (a) Centroid method
- (b) Center of largest area method
- (c) First of maxima and last of maxima method
- (d) Mean-max membership method

7. The two fuzzy vectors of length 5 are defined as $P = [0.1, 0.3, 0.9, 0.5, 0.4]$ and $Q = [0.2, 0.4, 0.5, 0.9, 1]$. Find the following: [4]

- (a) $P \cdot Q^T$
- (b) $P \cdot \bar{P}^T$
- (c) $P \oplus Q^T$
- (d) $Q \oplus \bar{Q}^T$

8. Determine the corresponding belief and plausibility measures from the table below. [7]

Focal elements	m
P	0.05
Q	0.05
R	0.05
$P \cup Q$	0.5
$P \cup R$	0.15
$Q \cup R$	0.05
$P \cup Q \cup R$	0.15

*** Best wishes ***

254, 252, 196, 193, 105

Name:



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM

Department of Computational Science and Humanities

END SEMESTER EXAMINATION - NOVEMBER, 2023

IMA311: Soft Computing

Date & Time: 22-11-2023, 09:30 A.M to 12:30 P.M

Max mark: 100

Course Instructor: Suriyapriya K

Batch: 2021 CSE-1&2

Calculator is permitted

Answer all Questions

1. Explain why the excluded middle law does not hold good in fuzzy logic with an example. [5]

2. Let $A = \frac{0.98}{-2} + \frac{0.69}{-1} + \frac{0.72}{0} + \frac{0.45}{1} + \frac{0.32}{2}$ and $B = \frac{0.9}{-2} + \frac{0.5}{-1} + \frac{0.97}{0} + \frac{0.56}{1} + \frac{0.4}{2}$.
Find the following:

[10]

- (a) $\overline{A \cup B}$
- (b) $\overline{A} \cap \overline{B}$
- (c) Support and height of \overline{A} and \overline{B}
- (d) ${}^{0.5}A$
- (e) ${}^{0.9+}B$
- (f) Height of A and B

3. Three fuzzy sets are defined as follows:

[8]

$A = \frac{0.1}{a} + \frac{0.2}{b} + \frac{0.4}{c}, B = \frac{0.7}{a} + \frac{0.9}{b} + \frac{0.8}{c}, C = \frac{0.5}{a} + \frac{0.3}{b} + \frac{0.25}{c}$.
Find:

- (a) $R = A \times B$
- (b) $S = B \times C$
- (c) $T = R \circ S$ using Max-min Composition.
- (d) Prove that $R \circ S \neq S \circ R$

4. A binary relation R from X to X is given by

[6]

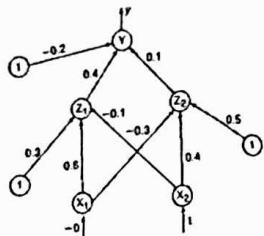
$$R = \frac{1}{(x_1, x_1)} + \frac{0.95}{(x_1, x_2)} + \frac{0.76}{(x_1, x_3)} + \frac{0.7}{(x_1, x_4)} + \frac{0.95}{(x_2, x_1)} + \frac{1}{(x_2, x_2)} + \frac{0.81}{(x_2, x_3)} + \frac{1}{(x_2, x_4)} + \frac{0.76}{(x_3, x_1)} + \frac{0.81}{(x_3, x_2)} + \frac{1}{(x_3, x_3)} + \frac{1}{(x_3, x_4)} + \frac{0.7}{(x_4, x_1)} + \frac{1}{(x_4, x_2)} + \frac{1}{(x_4, x_3)} + \frac{1}{(x_4, x_4)}.$$

Determine whether the relation R is an equivalence relation or a tolerance relation. Justify.
Also, find Domain of R , Range of R and Height of R .

- 5. Using the inference approach, obtain the membership values for the triangular shapes, Isosceles triangle, Right-angle triangle, Equilateral triangle for a triangle with angles 45° , 55° and 80° . [6]
- 6. Let X be the universal set and let P , Q and R be the subsets of X . The basic assignments for the corresponding focal elements are mentioned in the following table. Determine the corresponding belief measure. [7]

Focal elements	m
P	0.04
Q	0.04
R	0.04
$P \cup Q$	0.12
$P \cup R$	0.08
$Q \cup R$	0.04
$P \cup Q \cup R$	0.64

7. (a) Design a Hebb net to implement OR function (Consider bipolar inputs and targets). [8]
 (b) Using back-propagation network, find the new weights for the net shown in figure. It is presented with the input pattern $[0 \ 1]$ and the target output is 1. Use a learning rate $\alpha = 0.25$ and binary sigmoidal activation function. [14]



For clarity, the initial weights and bias are $v_{11} = 0.6, v_{21} = -0.1, v_{01} = 0.3, v_{12} = -0.3, v_{22} = 0.4, v_{02} = 0.5, w_1 = 0.4, w_2 = 0.1, w_0 = -0.2,$

- (c) Construct and test a BAM network to associate letters E and F with simple bipolar input-output vectors. The target output for E is $(-1, 1)$ and for F is $(1, 1)$. The display matrix size is 5×3 . The input patterns are [10]

$$\begin{matrix} * & * & * \\ * & \cdot & \cdot \\ * & * & * \\ * & \cdot & \cdot \\ * & * & * \end{matrix} \quad \begin{matrix} * & * & * \\ * & * & * \\ * & \cdot & \cdot \\ * & \cdot & \cdot \\ * & \cdot & \cdot \end{matrix}$$

"E" "F"

- (d) Consider a Kohonen self-organizing net with two cluster units and five input units. The weights vectors for the cluster units are given by $w_1 = [1.0 \ 0.9 \ 0.7 \ 0.5 \ 0.3], w_2 = [0.3 \ 0.5 \ 0.7 \ 0.9 \ 1.0]$. Use the square of the Euclidean distance to find the winning cluster unit for the input pattern $x = [0.0 \ 0.5 \ 1.0 \ 0.5 \ 0.0]$. Using a learning rate of 0.25, find the new weights for the winning unit. [10]

8. In a genetic algorithm,

(a) Miosis is the process of combining genetic material from two parents to produce offspring. [1]

(b) —— is the term used to represent a potential solution to the optimization problem. [1]

(c) The term "fitness" refers to —— [1]

(d) The purpose of the selection operator is ——. [1]

9. (a) ANFIS stands for Adaptive neuro fuzzy inference system [1]

(b) In ANFIS, the purpose of the "defuzzification" stage is ——. [1]

(c) The role of the rule layer in ANFIS is ——. [1]

- (d) The hybrid nature of ANFIS allows it to capture both _____ and neural network advantages. [1]
10. (a) The process of converting crisp inputs to fuzzy variables is called fuzzificati [1]
(b) The purpose of the term "linguistic variable" in fuzzy logic is _____. [1]
(c) The advantage of using fuzzy logic in decision making systems is _____. [1]
(d) The membership value of the elements in the Universe of discourse is 1. [1]
11. (a) The term "epoch" refers to _____. [1]
(b) hidden layer is responsible for learning features from input data. [1]
(c) The process of adjusting the weights of a neural network to minimize the error is known as _____. [1]
(d) The weighted sum of inputs and biases in a neuron is passed through the activation function. [1]

Roll No:..... 2021BCS0022

Name:..... V. Usha Sree



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computer Science and Engineering

FIRST MID SEMESTER EXAMINATION- SEP, 2023
COURSE TITLE: IEC 311 Digital Signal Processing

Time: 02.09.'23 09.30 – 11.00 AM

Max. Marks: 50

Course Instructor: Dr. Lidiya Lilly Thampi

Batch: 2021 CSE

Answer all Questions
Part A (5*1=5 Marks)

No clarification will be provided

Q1.

I. If $u(t)$ is the continuous-time unit step function, $\frac{du}{dt}$ is equal to:

- a. $r(t)$
b. $\delta(t)$
c. Unity
d. $\frac{t^2}{2}$

II. Evaluate the following integration $\int_{-5}^4 \delta(t - 4) dt$

- b. 1
c. 0
d. 5

III. The Dirac delta function $\delta(t)$ is defined as:

- a. $\delta(t) = \begin{cases} 1; & t = 0 \\ 0; & \text{otherwise} \\ \infty; & t = 0 \end{cases}$
b. $\delta(t) = \begin{cases} \infty; & t = 0 \\ 0; & \text{otherwise} \\ 1; & t = 0 \end{cases}$
c. $\delta(t) = \begin{cases} 1; & t = 0 \\ 0; & \text{otherwise} \end{cases}$ and $\int_{-\infty}^{\infty} \delta(t) dt = 1$
d. $\delta(t) = \begin{cases} \infty; & t = 0 \\ 0; & \text{otherwise} \end{cases}$ and $\int_{-\infty}^{\infty} \delta(t) dt = 1$

IV. The even component of signal $x[n] = 10$ is 10.

V. $\frac{d}{dt}$ (Even Signal with t) is odd signal.

Part B (5*3=15 marks)

Q2

I.

Define and sketch $x(t) = r(t) - r(t-1) - r(t-2) + r(t-3)$ where $r(t)$ is the unit ramp signal.

II.

$x[n] = (\frac{1}{2})^n u[-n-4]$. Then the sequence $y[n] = x[n-2]$ is _____.

III.

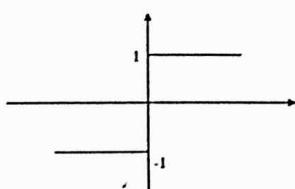
Are all analog signals are continuous-time? Demonstrate with an example.

IV.

Consider a signal, $x(t) = u(t-2) - u(t-4)$. Evaluate $\int_{-\infty}^{\infty} x(t) \delta(t) dt$

V.

The function $x(t)$ is shown in figure. Even and Odd parts of a unit step function $u(t)$ are respectively.



(a) $\frac{1}{2}, \frac{1}{2} x(t)$

(b) $-\frac{1}{2}, \frac{1}{2} x(t)$

(c) $\frac{1}{2}, -\frac{1}{2} x(t)$

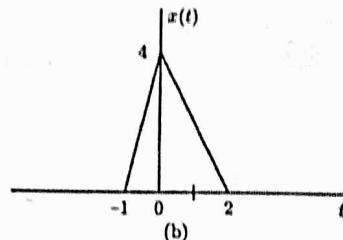
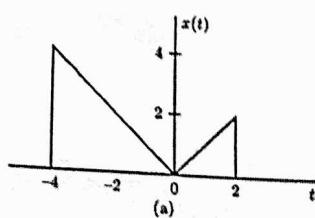
(d) $-\frac{1}{2}, -\frac{1}{2} x(t)$

$y(0) = 2$

Part C (6*5=30 marks)

Q3. A sequence of $x[n]$ is given $x[n] = [\frac{1}{2}, 1, 2, 1, \frac{1}{2}]$. Sketch $y[n] = \begin{cases} x\left(\frac{n}{2} - 1\right); & \text{for } n \text{ even} \\ 0; & \text{for } n \text{ odd} \end{cases}$

Q4. (a) Find and sketch dx/dt for the signal $x(t)$ shown in Fig.(a)
 (b) Find and sketch d^2x/dt^2 for the signal $x(t)$ shown in Fig.(b)



Q5. Find even and odd components of the following signal.

$$\text{a. } x[n] = e^{j\frac{\pi}{5}n} \quad \text{b. } \cos^2\left(\frac{\pi t}{2}\right)$$

Q6. Determine whether or not each of the following signal is periodic. If signal is periodic, determine its fundamental time periods and frequency.

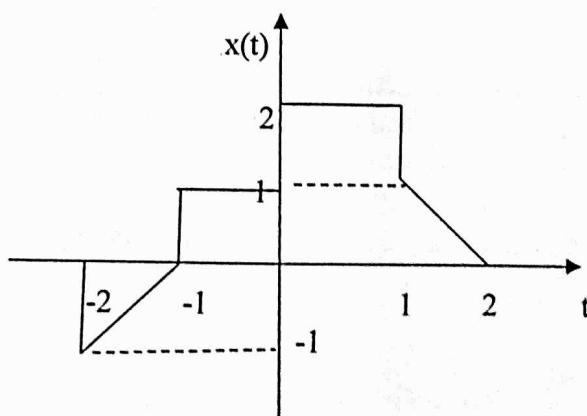
$$\text{a. } x_1[n] = \cos\left[\frac{\pi}{2}n\right]\cos\left[\frac{\pi}{4}n\right]$$

$$\text{b. } x_2[n] = 2\cos\left[\frac{\pi}{4}n\right] + \sin\left[\frac{\pi}{8}n\right] - 2\cos\left[\frac{\pi}{2}n + \frac{\pi}{6}\right]$$

Q7. Consider the sequence $x[n] = [-4-j5, 1+2j, 4]$, where $x[0] = 1+2j$. With suitable steps find the conjugate symmetric part and anti-symmetric part of the given sequence.

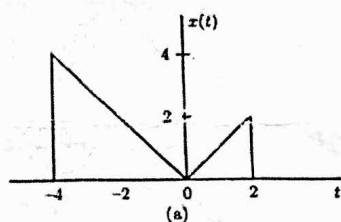
Q8. A continuous signal $x(t)$ is given in below Fig. Sketch and label carefully

$$\text{(a) } x(4-\frac{t}{2}) \quad \text{(b) } [x(t) + x(-t)]u(t) \quad \text{(c) } x(t)[\delta(t+\frac{3}{2}) - \delta(t-\frac{3}{2})]$$



Answer all Questions

1. A continuous signal $x(t)$ is given. Sketch and label each of the following signal
($2 \times 5 = 10$ Marks)
- $y(t) = 3x(2t + 3)$
 - $y(t) = x(-2t + 1)$



2. A discrete-time LTI system is both time-invariant and linear. Let the output be $y[n]$ when feeding with an input $x[n] = \delta[n]$,
($2 \times 5 = 10$ Marks)

Given $y[n] = \{0, 2, -1, 1\}$, where $n=0$ points to 2.

By using the properties of LTI system,

- plot the output $y_1[n]$ due to an input $x_1[n] = \delta[n-1]$.
- plot the output $y_2[n]$ due to an input $x_2[n] = 2\delta[n] - \delta[n-2]$

3. Compute the convolution of the following signals using graphical method
 $x(n) = \{1, 0, 2, 5, 4\}$ and $h(n) = \{1, -1, 1, -1\}$
(10 marks)

4. Consider the signal $x(t) = \begin{cases} A & 0 \leq t \leq t_1 \\ 0 & t_1 \leq t \leq \infty \end{cases}$
(10 marks)
Sketch the given signal and find energy and power.

5. (a) Define the term transfer function. Consider a discrete-time LTI system described by the difference equation. Determine the transfer function and hence find the frequency response.

$$y[n] + y[n-1] + 0.25y[n-2] = x[n-1] - 0.5x[n-2]$$

(6 marks)

- (b) Relate DTFT and DFT

(4 marks)

6. Design a linear phase FIR band pass filter to pass frequencies in the range 0.35π to 0.6π radians/sec using hanning window by taking 7 samples of window sequence. Determine the frequency response of the filter (15 marks)

7. Determine whether or not each of the following signal is periodic. If signal is periodic, determine its fundamental time periods and frequency. (sketch the signal if needed). (4*3=12 marks)

a. $x[n] = \cos[\frac{\pi}{2}n]\cos[\frac{\pi}{4}n]$

b. $x(t) = 2\cos(10t + 1) - \sin(4t - 1)$

c. $x(t) = e^{-2t}u(t)$

d. $x[n] = 3e^{j3/5(n+1/2)}$

8. Determine the DFT of $x[n] = \cos(0.25\pi n)$, $n = 0, 1, 2, \dots, 7$ (10 marks)

9. a. Design a Butterworth low pass filter of order 2, using Bilinear transformation for the following specifications (10 marks)

$$0.8 \leq |H(e^{j\omega})| \leq 1 ; 0 \leq \omega \leq 0.2\pi$$

$$|H(e^{j\omega})| \leq 0.2 ; 0.6\pi \leq \omega \leq \pi$$

- b. List the consequences of Warpping Effect. Suggest a solution to this problem. (3 marks)

$$\Omega_T = \omega$$

The relation between Ω_T & ω (an)

-es non-linear transform due to distortion introduced in the freq response of digital to analog filter

$$\frac{A_s^2}{A_s^2} \times \left(\frac{A_p^2}{(1-A_p^2)} \right)^{\frac{1}{4}} \times (24)^{\frac{1}{4}} = \frac{2 \tan \frac{\omega}{2}}{1}$$

$$0.6144 \rightarrow 42.666$$



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computer Science and Engineering
SECOND MID SEMESTER EXAMINATION- OCT, 2023
COURSE TITLE: IEC 311 Digital Signal Processing

Time: 06.10.23 09.30 – 11.00 AM

Max. Marks: 50
Batch: 2021 CSE

Course Instructor: Dr. Lidiya Lilly Thampi

Answer all Questions
Part A (5*2=10 Marks)

Q1.

No clarification will be provided

I.
II.

Determine the Z-Transform of $x[n] = \{1, 2, 6, -2, 0, 3\}$, where origin points at 6.

The Z- transform of e^{-t} sampled at 10 Hz will be

- a. $\frac{z}{z-10}$ b. $\frac{z}{z-0.1}$
c. $\frac{z}{z-0.9}$ d. $\frac{z}{z-1.1}$

III.

How many minimum number of samples are required to exactly describe the given signal: $x(t) = 10 \cos(6\pi t) + 4\sin(8\pi t)$

- a. 8 samples per second
b. 2 samples per second

- b. 4 samples per second
d. 6 samples per second

IV.

Consider a delayed unit impulse $\delta[n - m]$. Then its Z-transform is $\underline{\underline{z^m}}$.

V. Whether the given system described by, $y(t) = e^{3t}x(t)$ is stable or unstable?

$\begin{matrix} 1 & x \\ 2 & \checkmark \end{matrix}$

Part B (4*4=16 marks)

Q2

I.

Which of the following statement is correct?

(a) "All periodic signals are power signals and all power signals are periodic".

(b) "All periodic signals are power signals and all power signals are not periodic".

Justify your answer with an example. unit

II.

Determine if the following system is causal, linear, time-invariant and stable.

$$y(t) = \sin(x(t+2))$$

III.

Describe the concept of Sampling with a neat sketch

IV.

Determine the conditions on the sampling interval T_s so that each $x(t)$ is uniquely represented by the discrete time sequence $x[n] = x[nT_s]$.

- a. $x(t) = \cos[\pi t] + 3\sin(2\pi t) + \sin(4\pi t)$
b. $x(t) = \cos(2\pi t) \frac{\sin(\pi t)}{\pi t} + 3\sin(6\pi t) \frac{\sin(2\pi t)}{2\pi t}$

(P.T.O)

Part C (3*8=24 marks)

Q3. Consider the following signal.

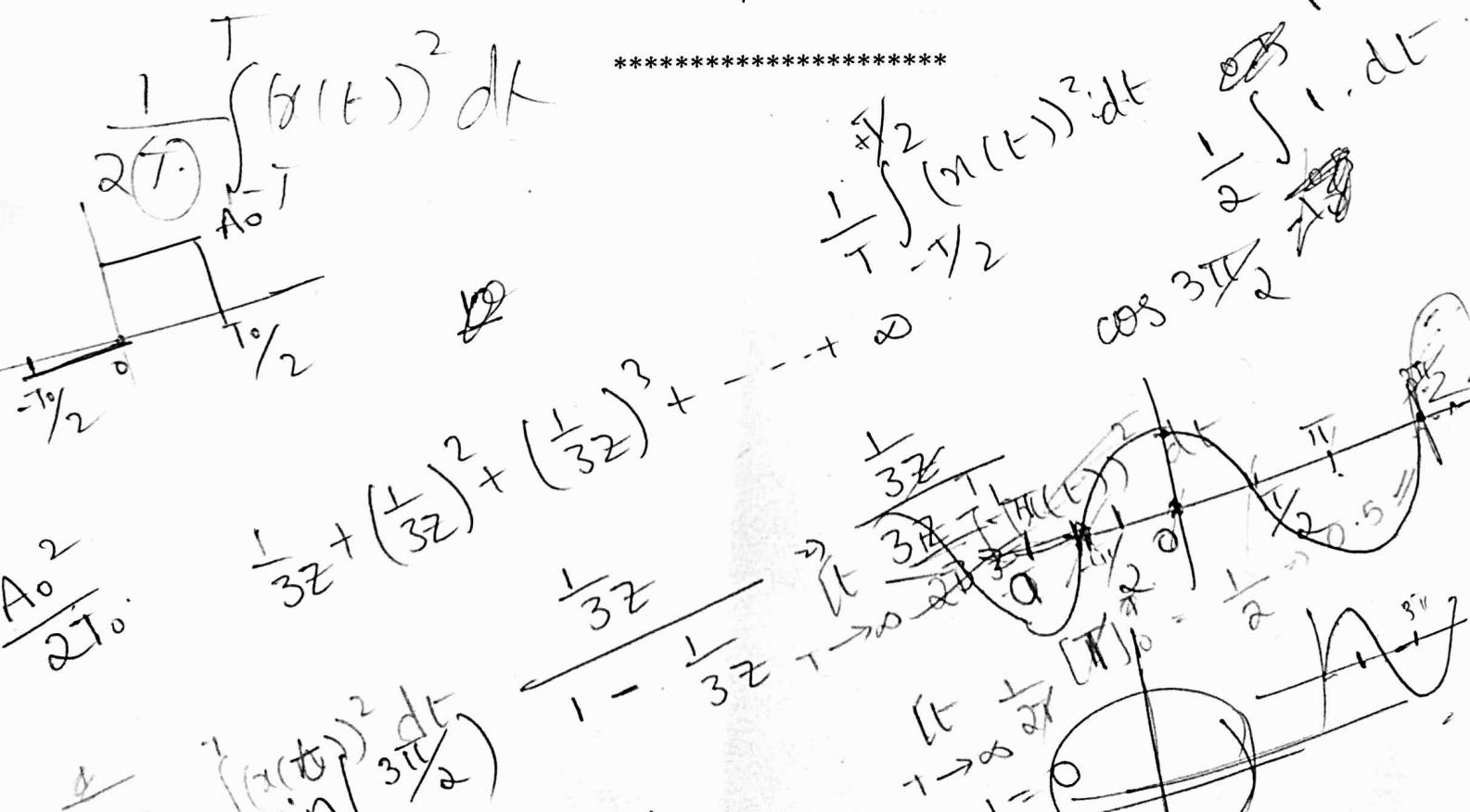
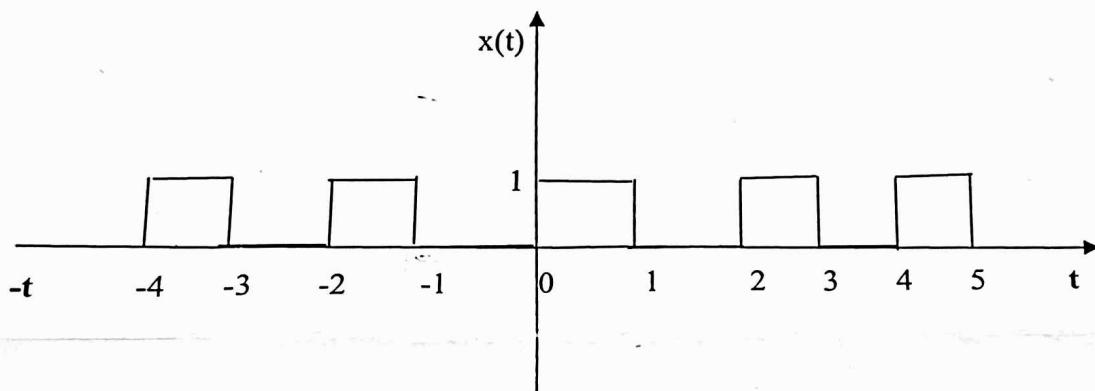
$$x[n] = \left(\frac{1}{3}\right)^n \sin\left(\frac{\pi}{4}n\right) u[n]$$

With a neat sketch represent the location of poles and zeros in Z-plane.

Q4. Determine the Energy and Power of the following signal

$$x[n] = e^{j(\frac{\pi}{2}n + \frac{\pi}{4})}$$

Q5. Write the Fundamental Time Period of the given signal $x(t)$. Find its Power and Energy. What is your inference regarding this calculations?



Name: ...2021BCS0022

Roll No.....



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computer Science and Engineering

FIRST MID SEMESTER EXAMINATION- September, 2023
COURSE TITLE: CSE 312 Software Engineering and Project Management

Time: 01-09-2023 2:30 PM - 4:00 PM

Course Instructor: Dr Nandini J. Warrier and Sujamol S

Max. Marks: 50

Batch: 1 and 2 (2021)

PART A (Each question carries 5 Marks) (5 x 5=25)

1. List 5 ambiguities or omissions in the following statement of SRS for part of a ticket-issuing system.

An automated ticket-issuing system sells rail tickets. Users select their destination and input a credit card and a personal identification number. The rail ticket is issued and their credit card account is charged. When the user presses the start button, a menu display of potential destinations is activated, along with a message to the user to select a destination. Once a destination has been selected, users are requested to input their credit card. Its validity is checked and the user is then requested to input a personal identifier. When the credit transaction has been validated, the ticket is issued. Provide short and concise 1-line answers.

2. Once a system has been installed and is regularly used, new requirements inevitably arise. What could be the reasons? List any five such reasons.

3. Now consider a dialogue box that will ask the user to upload a photo with certain conditions
A. You can upload only 'jpg' format image
B. file size less than 32kb
C. resolution 137*177.

If any of the conditions fails the system will throw a corresponding error message stating the issue and if all conditions are met then the photo will be updated successfully. Represent this complex logic using any two methods.

4. Discuss the scenario and criteria with an example for the following life cycle model:
a) Waterfall Model b) Spiral Model

5. Point out your opinion on usage of "GoTo" control structure. Write the alternatives for GoTo control structure.

PART B (10 Marks)

6. Complete the table using the following rating:

- a. Poor b. Good c. Excellent

Factors	Waterfall	Spiral	Evolutionary/Prototyping	Agile
Unclear Requirement	Good	Good	Prototyping	Poor
Unfamiliar Technology	Poor	Good	Prototyping	Poor
Complex System	Good	Poor	Evolution	Good
Reliable System	Excellent	Excellent	Evolution	Good
Short Time Schedule	Good	(Poor)	Prototyping	Excellent
Strong Project Management	Excellent	Excellent	Evolve	Excellent
Cost Limitation	Poor	Good	Prototyp	Excellent
Visibility of Stakeholders	Excellent	Excellent	Prototyp	Good
Skill Limitation	Good	Good	Prototyp	Excellent
Documentation	Good	Excellent	Evoluti	Good
Component Reusability	Good	Poor	Prototypic	Poor

Part C (15 marks)

7. The case study titled Library Management System is library management software for the purpose of monitoring and controlling the transactions in a library. This case study on the library management system gives us the complete information about the library and the daily transactions done in a Library. We need to maintain the record of books in the library which mainly focuses on basic operations in a library like adding new members, new books, searching books and members and facility to borrow and return books. It features a familiar and well thought-out, an attractive user interface, combined with strong searching, insertion and reporting capabilities. Librarians should be able to modify the book issue status, handle complaints, calculate fines, process the vendor details and issue and update the payment details. The end users in this case study are librarian, reader (registered and unregistered) and vendor. Write an SRS Document for the above scenario.



Name: Vrusha Sree
Roll No: 2021BCS0022

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computer Science and Engineering
Second Mid-Semester Examination- October 2023

CSE 312: SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

Date & Time: 05-10-2023, 02:30-04:00 PM
Course Instructor: Dr. Nandini J. Warrier, Dr. Sujamol S

Max.Marks:50
Batch:1 and 2(2021)

PART-A (5 × 3 = 15 marks)

1. Based on your experience with a bank ATM, draw an activity diagram that models the data processing involved when a customer withdraws cash from the machine.
2. For a healthcare system, propose a set of use cases that illustrate the interactions between a doctor, who sees patients and prescribes medicines and treatments.
3. "*Functional independence is a key to good design*". Justify this statement using two qualitative criteria.

PART B (10*2=20 marks)

4. A college offers correspondence courses to students. Each course lasts 20 weeks and is based on a progress test. At the end of the course, students attend an invigilated examination. The college Administrator deals with enquiries and applications, and eligible students are asked to register by completing and submitting an application form. After approval by the Junior Administrator, the application form is returned to the Administrator who creates a student file. The Accounts department receives the application form and using information from the student file, creates an invoice that is sent to the student. Payments made are registered on the invoice file. The first batch of student material and tests are issued from the library only to students who have paid fees (this information is taken from the invoice file). Progress tests and results are marked by academic staff together with comments and are sent out with next week's study block. The library will only issue study material/progress tests when a student has returned test answers from the previous week. Draw the context diagram and level-1 DFD.
5. A program reads three integer values. The three values are interpreted as representing the length of sides of a triangle. The program prints a message that states whether the triangle is scalene, isosceles or equilateral.
 - a. Develop a set of test cases that you feel will adequately test this program. (5 marks)
(Equilateral Triangle: A triangle is said to be an equilateral triangle if all the angles are equal. Isosceles Triangle: A triangle is said to be an isosceles triangle if any of two angles are equal. Scalene Triangle: A triangle is called Scalene Triangle if none of its angles are equal).
 - b. Is unit testing possible or even desirable in all circumstances? Provide an example and justify. (5 marks)

PART C (15*1=15 marks)

6. For the code given below:

- a. Draw the CFG (4 marks)
- b. Determine the cyclomatic complexity of the resultant flow graph. (3 marks)
- c. Determine the set of linearly independent paths. (4 marks)
- d. Prepare test cases that will force execution of each path in the linearly independent path identified. (4 marks)

Source Program:

```
int binsearch(int x, int v[], int n)
{
    int low, high, mid;
    1 | low = 0;
    high = n - 1;
    while (low <= high) | 2
    {
        3 | mid = (low + high)/2;
        if (x < v[mid])
            high = mid - 1; | 4
        5 | else if (x > v[mid])
            low = mid + 1; | 6
        7 | else return mid;
    }
    return -1; | 8
} | 9
```

Note that there should be 9 vertices in the CFG, marked between 1 to 9 in the source program.

Roll No:..... 2021BCS0022

Name:..... Usha



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computer Science and Engineering

END SEMESTER EXAMINATION- NOVEMBER, 2023

COURSE TITLE: CSE312 Software Engineering and Project Management

Time: 9.30am-12.30pm

Course Instructor: Dr. Nandini J. Warrier, Dr. Sujamol S

Max. Marks: 100

Batch: 1 & 2(2021)

Answer all Questions

PART A (Each question carries 8 Marks)

1. A software company needs to develop a project that is estimated to have 1000 function points and is planning to use JAVA programming language whose approximate lines of code per function point is 50. Considering $a=1.4$, $b=1.0$, $c=3.0$ and $d=0.33$, how long does it take to complete the project, assuming basic COCOMO model.
2. Explain how the principles underlying agile methods lead to the accelerated development and deployment of software.
3. Consider a scenario where a project team is trying to complete a project traditionally in nature. The expected duration of the project is 12 weeks or 3 months. The plan is to complete the project at the earliest and all team members are to be available for the project at any time. The team includes Ram (requirement engineer, UI designer), Shyam (System architect, developer), Keerthi (Developer and QA expert), Mahima (QA expert) and Vidya (QA expert). An initial WBS (Work Breakdown structure) was developed as given below in a tabular format (the milestones are highlighted with (*)).

Is this WBS, a correct one? If yes, justify. Otherwise, cite the issues with the WBS and suggest modifications.

ID	WBS Task Name	Predecessor	Duration in weeks	Resource Name
1	Requirement specification (*)	-	2	Ram
2	System Design	1	3	Shyam, Ram
2.1	Design of system architecture	1	1	Shyam
2.2	UI Design	2.1	2	Ram
3	Implementation (*)	1	5	Ram, Keerthi
4	Integration and system testing and usability testing (*)	3	1	Mahima, Keerthi

4. Discover at least 6 ambiguities or omission in the following statement of the requirement for part of a drone system intended for search and recovery:

The drone, a quad chopper, will be very useful in search and recovery operations, especially in remote areas or in extreme weather conditions. It will click high resolution images. It will fly according to a path preset by a ground operator, but will be able to avoid obstacles on its own, returning to its original path whenever possible. The drone will also be able to identify various objects and match them to the target it is looking for.

5. Develop a sequence diagram showing the interactions involved when a student registers for a course in a university. Courses may have limited enrollment, so the registration process must include checks that places are available. Assume that the student accesses an electronic course catalog to find out about available courses.

PART B (Each question carries 15 Marks)

6. AT 4.30 PM one day the BBC news team heard of a Government minister resigning. They wish to prepare an item on the event for that evening's 6 PM news. The table below lists the jobs needed to prepare this news item, the time each job takes and the constraints on when the work can commence.

JOB	Time needed in minutes	Constraint
A Interview the resigning Minister	15	Starts at 4.30 PM
B Film Downing St.	20	None
C Get reaction from regions	25	Cannot start until A and B are completed
D Review possible replacements	40	Cannot start until B is completed
E Review the minister's career	25	Cannot start until A is completed
F Prepare film for archives	20	Cannot start until C and E are completed
G Edit	20	Cannot start until A, B, C, D, E and F are completed.

- a. Construct an activity network for this problem and by finding the critical path in your network, show that the news item can be ready before 6 PM that day. (8 marks)
 b. If each of the jobs A, B, C, D, E and F needs a reporter, and once a reporter has started a job the same reporter alone must complete it, find out the minimum number of reporters required to have the news item ready before 6PM. Justify your answer. (7 marks)

✓ 7. Provide examples for the following:

- a. Give at least three precise examples in which black box testing might give the impression that "everything is OK" while white box tests might uncover an error. (7.5 marks)
- b. Give at least three precise examples in which white box testing might give the impression that "everything is OK" while black box tests might uncover an error. (7.5 marks)

✓ 8. Identify possible objects in the following systems and develop an oriented design, activity diagram and a sequence diagram for them.

- a. A group diary and time management system is intended to support the timetabling of meetings and appointments across a group of co-workers. When an appointment is to be made that involves a number of people, the system finds a common slot in each of their diaries and arranges the appointments for that time. If no common slots are available, it interacts with the user to rearrange his or her personal diary to make room for the appointment. (7.5 marks)
- b. A filling station is to be set up for fully automated operation. Drivers swipe their credit card through a reader connected to the pump; the card is verified by communication with a credit company computer, and a fuel limit is established. The driver may then take the fuel required. When fuel delivery is complete and the pump hose is returned to its holster, the driver's credit card account is debited with the cost of the fuel taken. The credit card is returned after debiting. If the card is invalid, the pump returns it before fuel is dispensed. (7.5 marks)

✓ 9. Consider the following code:

```
(1) Read x  
(2) y=1  
(3) If (x < 0)  
    (4)     Then print "Invalid Input"  
    (5) Else counter=1  
    (6)     {Repeat  
        (7)         y=y*counter  
        (8)         counter=counter+1  
        (9)         Print y  
    (10)     Until (counter > x)}  
    (11) End If  
(12) End
```

- a. Draw the Control Flow Graph and compute the cyclomatic complexity (7 marks)
- b. Write the test data for statement coverage, branch coverage and path coverage. (8 marks)

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of <Computational Humanities>



Indian Institute of
Information Technology
Kottayam

END SEMESTER EXAMINATION- NOVEMBER, 2023
COURSE TITLE: <IHS 311> <Human Resources Management>

Time: <9.30 AM-12.30 PM >

Max. Marks: 100

Course Instructor: <Dr Mathew C D >

Batch: <1& 2 >

ANSWER ALL QUESTIONS -10 marks each

- ✓ 1. Explain the importance and scope of Human Resource Management (HRM). Elaborate the relevance of HRM in the current scenario.
- ✓ 2. Explain the objectives of Human Resource Planning (HRP). Describe the process of HRP with illustrations.
- ✓ 3. Describe the objectives and benefits of performance appraisal. Briefly explain the process of performance appraisal.
- ✓ 4. Explain the importance of training in an organisation. Enumerate the steps involved in the training process.
- ✓ 5. Write short notes on any **four** of the following:
 - (a) Job Description
 - (b) Fourth Industrial Revolution
 - (c) Sources of Manpower
 - (d) Participative Decision-making
 - (e) Functions of Trade Unions
 - (f) Human Resource Development System
- ✓ 6. Explain HR Analytics with due importance on a) Data b) Metric c) Analytic
- ✓ 7. Explain Employee Stock Option Programme (ESOP) and how it's used in Startups as a retention tool.
- ✓ 8. If the allowed time for a job is 10 hours and the hourly rate is 4, calculate the earnings of workers A, B, and C who completes the job in 10 hours, 12 hours, and 8 hours respectively using Hasley Plan
- ✓ 9. The standard time and rate for the subassembly of a television are fixed as 6 hours and 50 per hour respectively. Calculate the bonus, total earnings, and effective hourly rate of four workers A, B, C, and D, if they save, 1 hour, 2hours, 3 hours, and 4 hours respectively from the standard time under Rowan plan.
- ✓ 10. Explain how attrition could be controlled in a service based IT company. Also explain how differential and competitive compensation could be implemented in order to attract the best talents.

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of CSE and ECE



END SEM EXAMINATION- NOVEMBER, 2023
COURSE TITLE: IHS 312 Financial Management and Accounting

Time: 09:30 am-12:30pm Max. Marks: 100

Course Instructor: Dr Raghunadhan T

Batch: I & II

Answer all Questions

Part A

(This section contains 30 MCQs. Answer all Questions/ No negative marks for wrong answers)

Total marks: 30

Marks each question carries: 1 mark each

1. Financial Management in organization have the thrust on

- (a) Maximisation of Capital Structure
- (b) Maximisation of Share holder's wealth
- (c) Ensuring financial discipline in the firm
- (d) Credit Management

2. The concept of Financial Management

- (a) Profit maximisation
- (b) All features of obtaining and using financial resources for company operations
- (c) Organization of funds
- (d) Effective Management of every company

3. What is the primary goal of financial management?

- (a) To maximise the owner's wealth
- (b) To minimize the risk
- (c) To maximise the return
- (d) To raise profit

4. The Finance Manager is accountable for

- (a) Earning Capital assets of the company
- (b) Effective management of fund
- (c) Arrangement of financial resources
- (d) Proper utilization of funds

5. Financial Management ensure

- (a) Availability of Funds
- (b) Planning and Organizing
- (c) Controlling financial activities
- (d) All the above

6. Finance function focus on

- (a) Expenditure of funds
- (b) Safe custody of funds
- (c) Procurement and effective utilization of funds
- (d) Procurement of finance

7. Identify the correct sequence of steps involved in decision making for change of technology

- (a) Conducting initial comparisons of alternative technologies
- (b) Evaluating the state of present technology
- (c) Listing down the probable post implementation issues
- (d) Financial feasibility analysis of proposed technology
- (e) Identifying the learning requirements

Choose the correct answer from the options given below:

1. D,C,A,E,B
2. B,A,D,E,C
3. A,B,C,E,D
- 4. D,E,A,B,C**

8. A decision for replacing machines with modern machinery of higher production capacity is a

- (a) Financing Decision
- (b) Investment Decision
- (c) Working Capital Decision**
- (d) Capital Budgeting

9. Indicate the correct combination of the financial decisions from the following

- I. Investment decisions
- II. Financing Decisions
- III. Pricing Decisions
- IV. Liquidity management decisions
- V. Dividend Decisions

Choose the correct answer from the code given below:

- (a) Only I, II, III and IV**
- (b) Only II, III, IV and V
- (c) Only I, II, IV and V
- (d) Only I, II and III

10. Business finance is needed to

- (a) Establish a business
- (b) Run a business
- (c) Expand a business
- (d) All of the above**

11. Which of the following is not a feature of a financial plan

- (a) Simplicity**
- (b) Cost
- (c) Flexibility
- (d) Foresight

12. M/s Orion Limited is a company dealing in ready-to-eat food products. Over the years, the earning potential of the company has gone up and it enjoys a good reputation. The Financial Manager is confident of the fact that not just the earnings of the current year, but of our future years are likely to be high. Identify the related factor of dividend decision being described in the given lines.

- (a) Earnings
- (b) Stability of earnings
- (c) Stability of dividend
- (d) Growth prospects

13. Net working capital refers to _____

- (a) Total assets minus(-) fixed assets
- (b) Current assets minus(-) Inventories
- (c) Current assets minus(-) Current Liabilities
- (d) Current assets plus Current Liabilities

14. Working capital indicates

- (a) Cash required for managing day to day activities of business
- (b) Funds required to buy inventory
- (c) Funds required to pay for loans
- (d) Cash required to buy assets

15. Working capital requirements are low when an organization has

- (a) High technology
- (b) High Debtors
- (c) High Inventory
- (d) High Creditors

16. Procurement of long term asset should be made from:

- (a) Debt funds
- (b) Miscellaneous funds
- (c) Long term funds
- (d) Reserves and Surpluses

17. A high current ratio may be due to:

- (a) Inventory piling up
- (b) Inefficiency in collection of debtors
- (c) High balance in cash and bank without proper investment
- (d) All the above

18. Component of Return are:

- (a) Yield plus Capital Gain
- (b) Profit and Loss
- (c) Dividend plus Bonus
- (d) None of the above

19. Financial forecasting can be broadly divided into

- (a) Market and Delphi Research Method
- (b) Projected P & L Account and Cash flow
- (c) Qualitative and Quantitative
- (d) None of the above

20. Retained earnings are

- (a) Internal source of funds
- (b) External sources of funds
- (c) Both
- (d) None of the above

21. A policy of consistency in the payment of dividend is known as

- (a) Stable dividend policy
- (b) Strict dividend policy
- (c) Liberal Dividend Policy
- (d) None of the above

22. Which of the following is an argument for the relevance of dividends?

- (a) Informational content
- (b) Reduction of uncertainty
- (c) Some Investors' preference for current income
- (d) All of the above

23. The term Capital Structure refers to

- (a) Long term debt, preferred stock and common stock equity
- (b) Current assets and Current Liabilities
- (c) Total assets minus liabilities
- (d) Shareholders' equity

24. You want to buy an ordinary annuity that will pay you Rs. 4000 per year for next 20 years. You expect annual interest rates 8% over that time period. The maximum price you would be willing pay for the annuity is closest to

- (a) Rs. 32,000
- (b) Rs. 39,272
- (c) Rs. 40,000
- (d) Rs. 80,000

25. With continuous compounding at 10% for 30 years, the future value of an initial investment of Rs. 2000 is closest to

- (a) Rs. 40,171
- (b) Rs. 34,898
- (c) Rs. 1,64,599
- (d) Rs. 3,28,282

26. In three years you are to receive Rs.5000/- If the interest rate were suddenly increase, the present value of that future amount to you

- (a) Will rise
- (b) Will fall
- (c) Remain unchanged
- (d) Cannot be determined without more information

27. According to the accounting profession, which of the following would be considered a cash flow item from an 'Investing' activity

- (a) Cash inflow from interest income
- (b) Cash inflow from dividend income
- (c) Cash outflow to acquire fixed assets
- (d) All of the above

28. Which of the following would be included in a cash budget

- (a) Depreciation charges
- (b) Dividends
- (c) Goodwill
- (d) Patent amortization

29. For a profitable firm, total sources of funds will always _____ total uses of funds

- (a) Be equal to
- (b) Be greater than
- (c) Be less than
- (d) Have no consistent relationship to

30. What is investment

- (a) Net addition to the Bank Account
- (b) Employment of Labour and infrastructure
- (c) Employment of Funds on assets to earn returns
- (d) Money required Production Process

Part B

[Descriptive type Questions/Problems]

*Answer only SIX questions out of the 8 questions given below
(In respect of the problems given below, solve the problem showing formula and detailed working sheet depicting every step in calculation for the easy understanding to Management. Write comments, as a report to the management on your recommendation)*

Marks each question carries: 5

Total marks: 30

31. To avoid problems of shortage and surplus of funds, what is required in Financial Management?
 Name the concept and explain four points of importance.

32. Explain the role of 'Operational efficiency' in the determination of Working Capital Management?

33. Why Capital budgeting decisions are more important?

34. What do you mean by Cost of Capital? How it is determined? Explain its significance

35. Mr X bought 10 shares in Swastik Co Ltd at price of Rs. 150 per share. After a year Company declared dividend at 20 per Share. Mr X wants to sell these shares, and the realisable value of each share is Rs. 180. Calculate total return on these showing (i) income and (ii) capital yields separately.

36. From the following information of M/s Simco Ltd.you are required to calculate:

(a) Net operating cycle period

(b) Number of operating cycles in a year

11-W118
AM

Financial Statement of M/s Simco Limited

1	Raw material inventory consumed during the year	Rs. 6,00,000	✓
2	Average stock of raw material	Rs. 50,000	✓
3	Work in progress inventory	Rs. 5,00,000	✓
4	Average work in progress inventory	Rs. 30,000	✗
5	Finished goods inventory	Rs. 80,00,000	+
6	Average finished goods stock held	Rs. 40,000	+
7	Average collection period from debtors	45 days	
8	Average credit period availed	30 days	
9	No. of days in a year	360 days	

37. M/s Cisco Ltd. issues 12% debentures of face value of Rs.100 each and realizes Rs. 95 per debture. The debtures are redeemable after 10 years at a premium of 10%. Calculate cost of capital ?

38. Suppose an investment of Rs.25,000/- can earn 10% interest each year for next five years. The interest is compounded annually.

- (a) Calculate Future Value (FV) of money
- (b) Calculate Present Value (PV) of money of Rs. 1,00,000 that will be received after five years (FV) at 10% interest rate

Part C

[Descriptive Questions]

(Answer only FOUR questions out of the 6 questions given below)

In respect of the problems given below, solve the problem showing every step in calculation for the easy understanding of Management. Write comments to the management on your recommendation)

Marks each question carries: 10

Total marks: 40

39. 'If managers can't think of anything else to do with their money they should pay dividends. If they have good places to invest, that's much better'...Define Dividend? Elaborate various types of Dividends?

40. 'Success of life is the result of good judgement. Good judgement is usually the result of experience. Experience is usually the result of bad judgement'.....Explain the role of Finance Manager in financial planning, financial management and financial forecasting?

41. 'Never take your eyes off the cash flow because it's the Life blood of business'...(Richard Branson). What is Cash Management? Discuss its objectives, problems, influencing factors, cash planning and cash control?

42. A proforma cost sheet of M/s Spark Ltd. provides the following particulars

Particulars	Amount per unit
Elements of Cost	
Raw materials	Rs. 80
Direct Labour	Rs. 30
Overhead	Rs. 60
Total Cost	Rs. 170
Profit	Rs. 30
Selling Price	Rs. 200

The following further particulars available:

Raw materials in stock on average, one month

Materials in process (Completion stage, 50%) on average

Finished goods in stock, on average one month

Credit allowed by suppliers is one month

Credit allowed to debtors is two months

Average time lag in payment of wages is 1.5 weeks and one month in overhead expenses

One fourth of the output is sold against cash

Cash in hand and bank is desired to be maintained at Rs. 3,65,000

You are required to prepare a statement showing the working capital needed to finance a level of activity of 1,04,000 units of production. You may assume that production is carried on evenly throughout the year and wages and overheads accrue similarly. For calculation purpose, 4 weeks may be taken as equivalent to one month

43. a) Explain Walter's Model on Dividend Decision Theory?

b) The earnings per share of a company are Rs.10. The rate of capitalization is 10% and the retained earning can be employed to yield a return of 20%.

The company is considering a payout of :

- (a) 20%
- (b) 40%
- (c) 60%

Which of these would maximise the wealth of the shareholders as per Walter's model?

44. Calculate Average Rate of Return for the projects given below?

	Project A	Project B
Investment	4,000	3,000
Expected Life	4 years	4 Years

Income shown after Depreciation and Tax

Year	Project A	Project B
1	2000	3000
2	1500	3000
3	1500	2000
4	1000	1000

Write detailed justification report to the management

Roll No:.....2021BCS0022

Name:.....V. Usha Sree



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of < Computational Humanities>

END SEMESTER EXAMINATION- NOVEMBER, 2023

COURSE TITLE: <IHS 313> <Operations and Supply Chain Management>

Time: <9.30 AM-12.30 PM>

Max. Marks: 50

Course Instructor: <Dr Mathew C D>

Batch: <1&2>

ANSWER ALL QUESTIONS -10 marks each

1. (a) Describe any four activities performed by the Operations Manager in a software development organisation. (b) "A poor layout will result in continuous losses in terms of higher effort for material handling, more scrap and rework, poor space utilization etc." What are the objectives and advantages of good plant layout? Discuss in detail.
2. Describe the Supply chain management model in Flipkart and elaborate how IOT is getting used in warehouse and in distribution
3. "Product layout is better than process layout." Do you agree with this statement? Support your answer
4. a) What is aggregate demand forecast? b) What are the differences between location and layout?
5. (a) Briefly explain Bullwhip effect. (b) Explain Pull vs Push effect in Supply chain ? (c) Discuss in detail the upstream and downstream in supplychain
6. How inventory control techniques works in real world? List out its importance.
7. ABC manufacturing company purchases 9000 parts of a machine for its annual requirement ordering one month usage at a time. Each part costs \$20/. The ordering cost per order is \$15/- and the carrying charges are 15% of the average inventory cost per year. Suggest a more economical purchasing policy for the company and how much the company saves per year with your advice. Derive the formula used, if any.
8. Long Beach Bank employs three loan officers, each working eight hours per day. Each officer processes an average of five loans per day. The bank's payroll cost for the officers is \$820 per day, and there is a daily overhead expense of \$500.
 - a. Compute the labor productivity.
 - b. Compute the multifactor productivity, using loans per dollar cost as the measure. The bank is considering the purchase of new computer software for the loan operation. The software will enable each loan officer to process eight loans per day, although the overhead expense will increase to \$550.
 - c. Compute the new labor productivity.
 - d. Compute the new multifactor productivity.
 - e. Should the bank proceed with the purchase of the new software? Explain.
9. A company makes bicycles. It produces 450 bicycles a month. It buys the tires for bicycles from a supplier at a cost of \$20 per tire. The company's inventory carrying cost is estimated to be 15% of cost and ordering is \$50 per order.

(PTO)

- a. Calculate the EOQ
 - b. What is the number of order per year?
 - c. Compute the average annual ordering cost
 - d. Compute the average inventory
 - e. What is the average annual carrying cost?
10. For a particular task 15 observations were taken by a time study observer. Check whether the number of observations is sufficient for 5% limit of accuracy and 95% confidence level. Indicate the minimum number of observations required.

Time (x in minutes)	Frequency (f)
1	2
2	3
3	3
4	4
5	3
