



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM

Department of Computer Science and Engineering

MID SEMESTER EXAMINATION- SEPTEMBER, 2024

COURSE TITLE: IEC 311 Digital Signal Processing

Time: 25/9/2024, 2:30-4 PM

Max. Marks: 50

Course Instructors: Dr. Ravi Ajmeera (B1), Dr. Della Thomas (B2), Dr. Debarati Ganguly (B3)

Batch: 2022 BCS, BCD

Answer all Questions

1.

a. List and prove the properties of Convolution theorem

$$\left[1 \frac{1}{2} * 3 = 4 \frac{1}{2} \right]$$

- (i) Associative Law
- (ii) Distributive Law
- (iii) Commutative Law

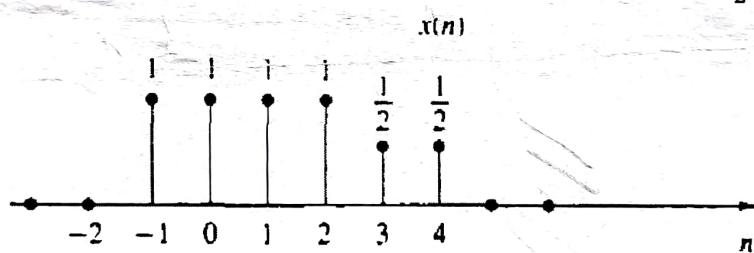
b. Find the Convolution of $x(n) = \{1, 2, 3, 4\}$ & $h(n) = \{1, 2, 1, -1\}$ by using Graphical method

$$\left[5 \frac{1}{2} \right]$$

2.

a. A discrete-time signal, $x[n]$ is shown below. Sketch and label carefully each of the signals stated below.

$$\left[1 \frac{1}{2} * 4 = 6 \right]$$



- (i) $x[n]u[2-n]$
- (ii) $x[n-1]\delta[n-3]$
- (iii) $x[n^2]$
- (iv) Even and Odd part of $x(n)$

b. Show that

i. $\delta[n] = u[n] - u[n-1]$

ii. $u[n] = \sum_{k=-\infty}^n \delta[k] = \sum_{k=0}^{\infty} \delta[n-k]$

$$[2 * 2 = 4]$$

3.

a. What is the difference between causal and non-causal signals? Determine whether the following signals are causal or non-causal.

$$[2 * 2 = 4]$$

(a) $y[n] = x[n] - x[n-1]$

(b) $y[n] = x[n^2]$

b. Determine whether the following signals are energy and power signals with proper explanations. [3 * 2 = 6]

- (i) $x[n] = r[n]$ where $r[n]$ is a unit ramp signal
(ii) $x[n] = \left(\frac{1}{2}\right)^n u[n]$
(iii) $x[n] = \cos[\pi n/2]$

4.

a. A discrete-time system can be (a) Static or dynamic (b) Linear or nonlinear (c) Time invariant or time varying (d) Stable or Unstable. Examine the following systems with respect to the properties above. [2.5 * 3 = 7.5]

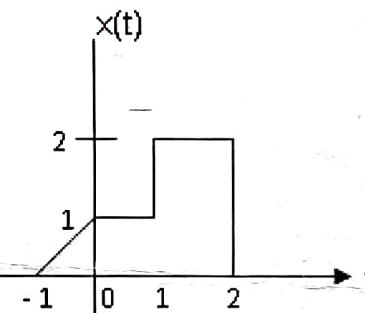
- (i) $y[n] = \cos x[n]$
(ii) $y[n] = x[n]\cos[\omega_0 n]$
(iii) $y[n] = x[-n + 2]$

b. Find the even and odd part of the signal, $x(n) = \{1 + j2, 2, j5\}$ [2.5]

5.

a. For continuous time signal $x(t)$ shown in figure, sketch the following signals?

[1.5 * 5 = 7.5]



- (i) $x(t - 4)$
(ii) $x(2t + 1)$
(iii) $x(5 - t)$
(iv) $x(-t - 2)$
(v) $[x(t) + x(-t)]u(t)$

b. Explain how input and output signals are related to impulse response of an LTI system [2.5]

*****ALL THE BEST*****



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computer Science and Engineering
END SEMESTER EXAMINATION - ODD 2024-'25

NOVEMBER 2024

COURSE TITLE: IEC311 DIGITAL SIGNAL PROCESSING

Date & Time: 22-11-2024, 9.30 AM-12.30 PM

Max. Marks: 100

Course Instructors: Dr. Ravi Ajmeera/ Dr. Della Thomas/ Dr. Emv

SEMESTER: V Batch: I, II, III

Answer All Questions

1. a) Find the fundamental period of following signal [5M]
- $$x(n) = e^{j0.2\pi n} + e^{-j0.3\pi n}$$
- b) Find the energy and power in the given input signal [5M]
- $$x[n] = 12e^{j\frac{\pi}{4}n}$$
2. a) Determine the impulse response of the following difference equation [5M]
- $$y[n] + 3y[n - 1] + 2y[n - 2] = 2x[n] - x[n - 1]$$
- b) Describe the block diagram of a Digital Signal Processing system and discuss its various applications. [5M]
3. Check whether the following systems are linear, shift variant, causal, static and stable. [10M]
- a) $y[n] = x[n] + nx[n + 1]$
- b) $y[n] = \log_{10}(x[n])$
4. a) Compute the linear convolution of $x(n) = \{1,2,4\}$ with $h(n) = \{1,1,1,1,1\}$. [5M]
- b) Determine the cross correlation between the sequences $x(n) = \{1,1,1,1\}$ and $y(n) = \{1,2,3,4\}$. [5M]
- c) Explain the aliasing effect. Given a continuous signal $x(t) = 2 \cos 300\pi t$. Identify the Nyquist rate of the signal. [5M]
5. Obtain the 8-point DIT FFT of given sequence using butterfly diagram. Show all the intermediate step calculations. [10M]

$$x[n] = \{8,8,8,0,1,4,2,3\}$$

6

Determine the inverse Z-transform of following function for all possible ROCs.

[5M]

$$X[z] = \frac{1}{1 - 1.5z^{-1} - 0.5z^{-2}}$$

7.

State and prove the following properties of Discrete Fourier Transform

[10M]

a) Linearity Property

b) Time shifting Property

c) Convolution Property

d) Conjugate Symmetry

8.

The transfer function of the analog filter is given by

[5M]

$$H(s) = \frac{2}{(s + 1)(s + 2)}$$

Determine H(z) using impulse invariance method.

9.

Given the filter specifications:

[15M]

$$\alpha_p = 1\text{dB}, \alpha_s = 30\text{dB}, \Omega_p = 200 \text{ rad/sec}, \Omega_s = 600 \text{ rad/sec}$$

Determine the order the filter and transfer function $H(s)$ of the filter.

10.

Design the realizable transfer function $H(z)$ from the given ideal high pass filter with a frequency response

[10M]

$$H_d(e^{j\omega}) = \begin{cases} 1, & \pi/4 \leq |\omega| \leq \pi \\ 0, & |\omega| \leq \pi/4 \end{cases}$$

using Rectangular window for $N=11$.



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM

Department of Computer Science and Engineering

MID SEMESTER EXAMINATION- SEPTEMBER, 2024

COURSE CODE & TITLE: ICS 311 Parallel and Distributed Computing

Date & Time: 24-09-2024 & 9.30 A.M-11.00 A.M

Max. Marks: 50

Course Instructors: Dr. Bhanu Chander & Dr. P. Balasubramanian

Batch: (I&II) 2022

Answer all Questions

1. (a) Let a program have 40 percent of its code enhanced $f_e = 0.4$ to yield a system speedup 4.3 times faster $S = 4.3$. What is the factor of improvement f_I of the portion enhanced? [5 M]

- (b) Consider an instruction pipeline with five stages: Fetch Instruction (FI), Decode Instruction (DI), Fetch Operand (FO), Execute Instruction (EI) and Write Operand (WO). The delays for the IF, ID, OF, EX, and OW are 5 ns, 7 ns, 12 ns, 8 ns, and 6 ns, correspondingly. There are intermediate storage buffers after each stage and the delay of each buffer is 2 ns. A program consisting of 12 instructions $I_1, I_2, I_3, \dots, I_{12}$ is executed in this pipelined processor. Instruction I_4 is the only branch instruction and its branch target is I_9 . Each stage takes 15 ns in total to complete. If the branch is taken during the execution of this program, how many stall cycles happen and how much time (in ns) needed to complete the entire program. [5 M]

- (c) A three-dimensional $r \times s \times t$ mesh is obtained by making t copies of an $r \times s$ mesh and joining the corresponding nodes in a line. An example is given below in Figure 1. Number the nodes in the 3-d mesh as $P_{i,j,k}$, where $1 \leq i \leq r$, $1 \leq j \leq s$, and $1 \leq k \leq t$. [10 M]

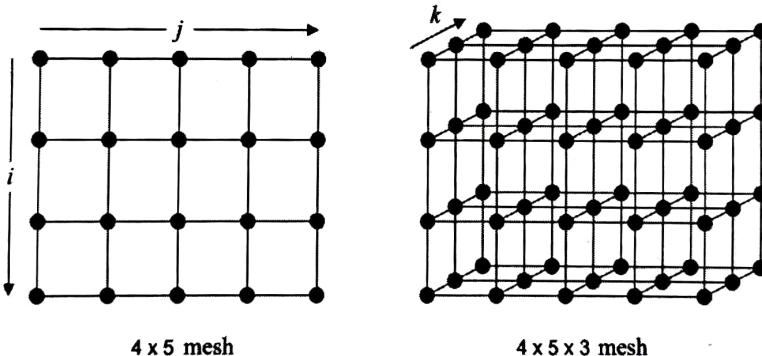


Figure 1: Mesh topology arrangement among the Processors. Edges between nodes represents the data movement from left-to-right and/or top-to-bottom.

Let $\mathbf{A} = (a_1, a_2, \dots, a_n)$ be an array of n integers, and we want to compute the sum $s = \sum_{i=1}^n a_i$. You are given an $m \times m \times m$ mesh with $p = m^3$ processors. Assume that $p \leq n$. For the sake of simplicity, you may further assume that n is an integral multiple of p .

Propose an efficient algorithm to compute the sum s on the given 3-d mesh. Clearly specify how the elements of \mathbf{A} are initially distributed among the p processors. Also, clearly specify the computations and communications involved in the algorithm. What is the running time of your algorithm?

[P.T.O]

3. Consider a task dependency graph given below in **Figure 2** and determine the following: [5 M]

- (a) Maximum Degree of Concurrency
- (b) Critical Path
- (c) Critical Path Length
- (d) Average Degree of Concurrency
- (e) In the Context of parallel programming, what we get from task dependency graphs

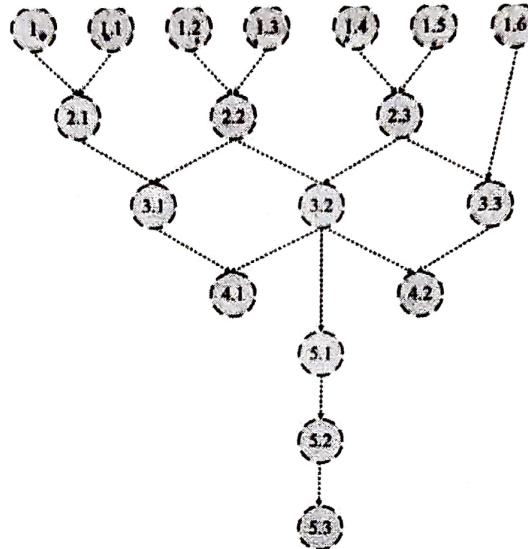
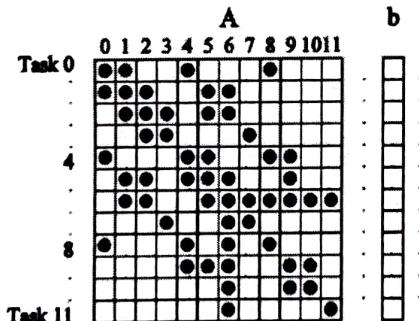
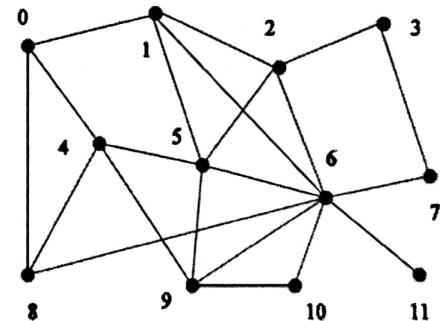


Figure 2: Task dependency graph for parallel formulation of problem

4. Consider the task interaction graph for the following Sparse Matrix, where $\mathbf{b}[i]$ is partitioned across the task, for example $\mathbf{t}[i]$ has only $\mathbf{b}[i]$. Then find the computation and communication for node 1, 5, and 8? What you infer from this graph in terms of parallel efficiency? [5 M]



(a)



(b)

Figure 3: (a) Sparse Matrix-Vector Product (b) Task interaction graph for (a)

5. 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 (**Figure 4**). We divide the interval $[0, 1]$ into k subintervals of equal size. We find the height of the curve at the midpoint of each of these subintervals. With these heights we can construct k rectangles. The area of the rectangles approximates the area under the curve.

[P.T.O]

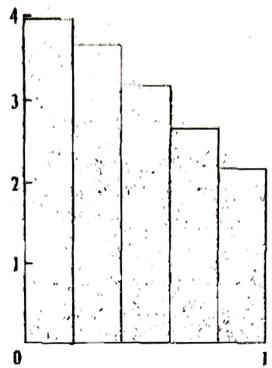


Figure 4: The rectangle rule is a simple way to approximate the area under a curve. In this example the function is $\frac{4}{1+x^2}$, and the area under the curve between 0 and 1 is π .

- (a) Write the **serial** version program with C/C++ to estimate the value of pi (π). [2 M]
 - (b) Write a **parallel** program using OpenMP with C/ C++ to compute π using the rectangle rule with $k=10$ intervals. You have to show the output with the number of threads of size 6 involved and the area calculated by which thread ID (number). [4 M]
 - (c) Identify the line of statement(s) which leads the **race condition**? If it exists, how will you handle this problem? Use all the appropriate OpenMP synchronization directives/clauses and compare different proposed solutions. [4 M]
6. (a) Write the algorithm for **serial odd-even transposition sort** to arrange the elements of size N in a sorted order. How serial **odd-even transposition sort** is not cost optimal in terms of asymptotic run time? Assume N =number of elements in an array. [4 M]
- (b) Write the **cost optimal parallel** formulation pseudocode/algorithm of odd even transposition sort. What are the **OpenMP directives/clauses** are involved to achieve parallelism and achieve consistency in the results? Justify them. [3 M]
- (c) Write the necessary steps according to the algorithm in (a) to sort the elements $N=10$, Unsorted Array: 19, 2, 72, 3, 18, 57, 603, 490, 45, 101. [3 M]

"The way the processor industry is going, is to add more and more cores, but nobody knows how to program those things. I mean, two, yeah; four, not really; eight, forget it"



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

END SEMESTER EXAMINATION- NOVEMBER, 2024
COURSE CODE & TITLE: ICS 311 Parallel and Distributed Computing

Date & Time: 29-11-2024 & 09.30 A.M-12.30 P.M

Max. Marks: 100

Course Instructors: Dr. Shajulin B, Dr. Bhanu Chander & Dr. Balasubramanian P

Sem.: V

Batch: 2022 (I, II & III)

Answer all Questions

PART-A

[10 x 2 = 20 Marks]

1. Consider yourself as a solution architect, you have designed a system for an application which demands high throughput, and typically process single instruction with multiple data. To process such application, which architecture (multi core or many core) is more suitable? Justify your answer with one suitable application satisfying such requirements.

2. An instruction format has the following structure:

Instruction Number: Opcode destination reg, source reg-1, source reg-2

Consider the following sequence of instructions to be executed in a pipelined processor:

I1: DIV R3, R1, R2

I2: SUB R5, R3, R4

I3: ADD R3, R5, R6

I4: MUL R7, R3, R8

What are the dependencies exist in the above instructions? Justify.

3. In parallel programming, Hybrid decomposition is a mix of decomposition techniques. Give any suitable example along with proper steps for hybrid decomposition.

4. Consider the following two threads T1 and T2 that update two shared variables a and b. Assume that initially $a = b = 1$. Though context switching between threads can happen at any time, each statement of T1 or T2 is executed atomically without interruption.

T1	T2
$a = a + 1;$ $b = b + 1;$	$b = 2 * b;$ $a = 2 * a;$

What are all the possible combinations of values of a and b after both T1 and T2 finish execution?

5. What are the merits and demerits of vector processors?

6. Write the optimized vector code for the following pseudocode using vector processors.

```
for (i=0; i<50; i++)  
{ b[i] += a[i];  
}
```

7. Consider an OpenMP code that includes the **MASTER** and **SINGLE** directives. When should these directives be used? What is the primary difference between them? Illustrate with example.

8. Consider the following OpenMP code snippet of Code (A) and Code (B). It consists of multiple critical sections (CS) namely **S1**, **S2** and **S3**. Assume **OMP_NUM_THREADS=5**. How many number of threads are possible that run inside the CSs S1, S2 and S3 in Code(A) and Code(B)? Justify.

Code (A)	Code (B)
....
#pragma omp critical { S1 }	#pragma omp critical IIIT { S1 }
....
#pragma omp critical { S2 }	#pragma omp critical IIIT { S2 }
....
#pragma omp critical { S3 }	#pragma omp critical NIT { S3 }

9. How does **MPI_Reduce** differ from **MPI_Allreduce** in collective communication? Suppose 4 processes (**P0, P1, P2, P3**) are defined in the MPI Communicator world with initial values 3, -22.5, 8.5 and 5. What is the result of these MPI functions with *sum* operation on the values of the processes? You are free to choose the rank of the root process from 0 to 3.

10. Consider 4 processes namely **P0, P1, P2** and **P3** have the integer values such as 1, 5, 9 and 13 respectively. What is the result of the **MPI_Alltoall** function? Write the MPI syntax of it.

PART-B

[8 x 10 = 80 Marks]

11. (a) A non-pipelined instruction execution unit operating at 2 GHz takes an average of 6 cycles to execute an instruction of a program P. The unit is then redesigned to operate on a 5-stage pipeline at 2 GHz. Assume that the ideal throughput of the pipelined unit is 1 instruction per cycle. In the execution of program P, 20% instructions incur an average of 2 cycles stall due to data hazards and 20% instructions incur an average of 3 cycles stall due to control hazards. What is the speedup (rounded off to one decimal place) obtained by the pipelined design over the non-pipelined design? [5 M]

(b) Briefly explain SIMD and MIMD architecture with neat diagram and example. [5 M]

12. Consider two n-dimensional vectors $\mathbf{u} = (u_1, u_2, \dots, u_n)$ and $\mathbf{v} = (v_1, v_2, \dots, v_n)$. The dot product between these two vectors are defined as $\mathbf{u} \cdot \mathbf{v} = u_1v_1 + u_2v_2 + \dots + u_nv_n$. Let $m = \sqrt{n}$ be an integer. You are given an $m \times m$ mesh with the processors numbered P_1, P_2, \dots, P_n in the row-major order. Suppose that the processor P_i is initially given the values u_i and v_i , and the final result is to be read from processor P_n , design an $O(\sqrt{n})$ -time algorithm to solve the problem in this setting. [10 M]

13. Consider the following scenario. A compiler consists of six distinct stages. The **tokenizer** translates characters (input from one or more files) into tokens. The **parser** translates tokens into procedures. The **canonicalizer** translates procedures into a canonical form. The **encoder** translates procedures in this canonical form into low-level code. The **optimizer** rewrites this low-level code. Finally, the **assembler** generates object code. Apply **Foster's design methodology** with domain and functional decomposition techniques to obtain two different parallel algorithms for the stages of compiler. Compare and contrast the scalability and expected efficiency of the two algorithms.

[10 M]

14. What are the important characteristics of vector processors? Write the assembly language code for following operations using the Instruction Set Architecture (ISA) of the scalar and vector processor.

$$C[i] = ((B[i] * C[i]) + d)/2;$$

where B, C are vectors of size 64 and d is scalar. Assume R_b contains starting address of B, R_c contains starting address of C, and R_d contains address of scalar d.

[5 + 5 = 10 M]

15. (a) Write the parallel code snippet with necessary OpenMP directives/clauses to estimate the value of π using the following numerical series with n=95 terms. [5 M]

$$\pi = 4 \left[1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots \right]$$

(b) Assume *number of threads*=5. How the iterations can be assigned in-prior to loop execution with **cyclic** schedule? Which OpenMP clause can be used to accomplish this task and write the OpenMP code in the appropriate line in the program. **Note:** *chunk_size* is omitted. [5 M]

16. (a) Write an **OpenMP** program to identify the speedup of a bubble sort algorithm. The input array A consists of 10 elements. $A = \{15, 129, 16, 213, -4, 415, 0, 192, 24, -118\}$ [5 M]

(b) Show the compare and swap steps iteration-wise for the input given in (a) and program written for (a). [5 M]

17. (a) Write a non-deadlock or safe state parallel algorithm in MPI that implements **Cannon's Matrix Multiplication** for multiplying two matrices P and Q of size $n \times n$. The result of the $A \times B$ is stored in another matrix C. Derive the asymptotic time analysis for the parallel algorithm of it? [5 M]

(b) Consider the following matrices **P** and **Q**. Perform Matrix multiplication using **Cannon's** algorithm mentioned in (a) with detailed steps. [5 M]

P				Q			
5	2	6	1	7	5	8	0
0	6	2	0	1	8	2	6
3	8	1	4	9	4	3	8
1	8	5	6	5	3	7	9

18. (a) Design a performance monitoring tool that could capture the hardware performance counters. Illustrate the explanation by writing an **OpenMP** code that demonstrates **Fibonacci series** less than 1000. The recurrence relation of the Fibonacci series is given as follows: $F(i)=F(i-1) + F(i-2)$, where, $i \geq 2$, and $F(0)=0, F(1)=1$. [5 M]

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 Name: Abhinav Bhagwad



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

MID SEMESTER EXAMINATION - SEPTEMBER, 2024

COURSE TITLE: CSE311 Artificial Intelligence

Time: 09:30 -11:00 AM

Date: 23.09.2024

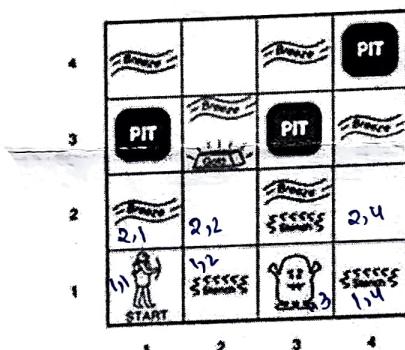
Max. Marks: 50

Course Instructors: Dr. Victer Paul / Dr. Sivaiah Bellamkonda/ Mr. Akarsh K

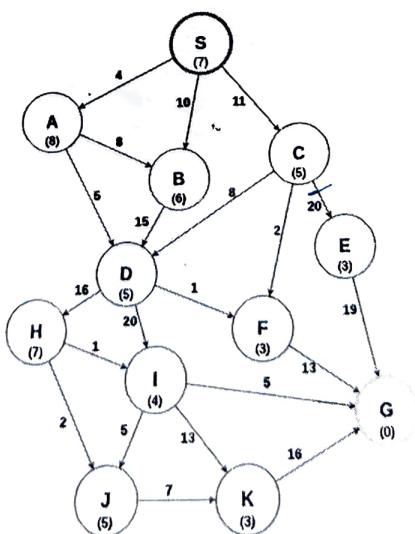
Batch: 1, 2, 3

Answer all Questions

1. Use Propositional logic concepts to solve the problem given. Prepare knowledge base, deduce using inference rules and prove "There is a Wumpus in the box [1,3]" [3M+7M]



2. Present the working of A* algorithm. Trace the algorithm and present the state space tree for the graph to find an optimal path from S→G, heuristic h(n) is given inside the node: [10M]



3. Given the following English sentences:

[5M+5M]

✓ Venkat eats veg-food.

✓ Prabhu eats non-veg-food.

✓ Lakshmi likes who eat biryani.

✓ Biryani is non-veg-food.

✓ Sambar is veg-food.

✓ Priya likes who eats veg-food.

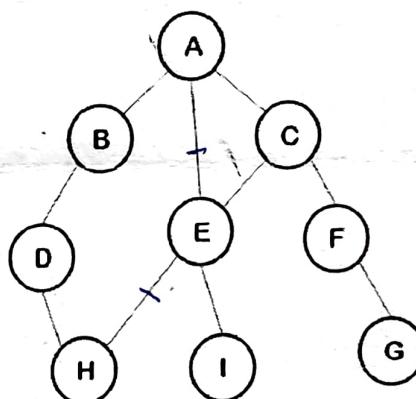
Convert to Prolog facts and Write rules required to answer the questions.

✓ Write query and output to answer 'Who eats Biryani?

✓ Write query and output to answer 'Whom does Priya likes?

Write query and output to answer 'Whom does Lakshmi likes?

4. Present the working of Iterative deepening depth first search. Trace the following graph to determine the depth limit to search node H. [10M]



5. A) A system engineer is seeking the most suitable uninformed search algorithm for his optimization model. Assist him by explaining the key parameters that can be used to assess the effectiveness of various search strategies. Additionally, compare different uninformed search algorithms based on these parameters. [5M]

B) A company is assembling a team of programmers to build an AI agent that can efficiently solve the Tower of Hanoi problem. As an AI system designer, outline the problem formulation for this specific task. [5M]

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computer Science & Engineering
END SEMESTER EXAMINATION - ODD 2024-'25

NOVEMBER 2024

COURSE TITLE: CSE 311 – ARTIFICIAL INTELLIGENCE

Time: 20.11.2024, 9:30 AM - 12:30 PM

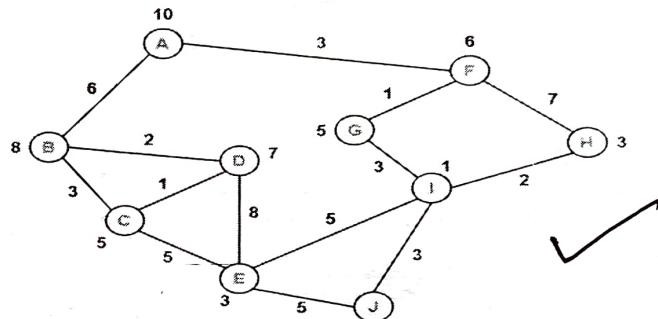
Max. Marks: 100

Course Instructor: Dr. P. Victer Paul Dr. Sivaiah Bellamkonda and Mr. Akarsh K Nair

Batch: 1, 2, 3

Answer All Questions

1. Given the following graph with heuristic specified along the node to reach J, which type of search algorithms are suitable for this problem? Apply any two search algorithms to find an optimal path from A to J, and compare them to specify which one is best: [5M+5M+5M]



2. A) Why fuzzy logic is needed for knowledge representation? How it is represented in a computer?

[5M + 5M]

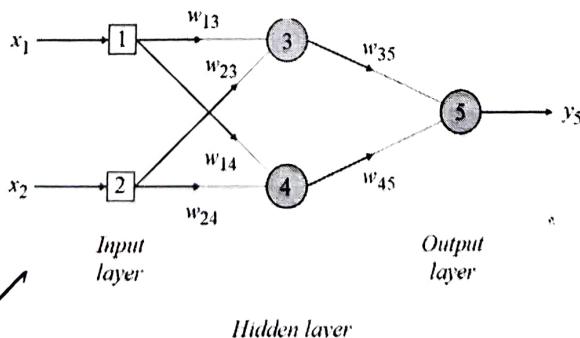
- B) Assume 'Mike' is a member of the fuzzy set 'rich people' with a value 0.45. Calculate the membership value for the fuzzy sets, 'slightly rich people', 'more or less rich people', 'very rich people' and indeed rich people'. [5M]

3. Assume the values given below, write and 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. [5M+10M]

$$x_1=1, x_2=1, y_5=1, w_{13}=0.5, w_{14}=0.9, w_{23}=0.4, w_{24}=1.0, w_{35}=-1.2, w_{45}=1.1$$

$$\alpha = 0.1$$

[Assume the values for $\theta_3 = 0.8$, $\theta_4 = -0.1$ and $\theta_5 = 0.3$ and bias as -1]



4. Design a mamdani style fuzzy inference system to adjusts Water Flow based on Temperature and Water Pressure. The fuzzy sets are defined as follows: **Water Flow**: {Low=[0, 0, 30, 50], Medium=[25, 50, 75], High=[50, 70, 100, 100]}, **Temperature**: {Cold=[0, 0, 20, 30], Warm=[25, 35, 40], Hot=[35, 45, 50, 50]} and **Water Pressure**: {Low=[0, 0, 10, 40], Medium=[30, 50, 70], High=[60, 80, 100, 100]}. The rules are:

- IF Temperature is Cold AND Pressure is Low, THEN Flow is Low.
- IF Temperature is Warm AND Pressure is Medium, THEN Flow is Medium.
- IF Temperature is Hot AND Pressure is High, THEN Flow is High.
- IF Temperature is Hot AND Pressure is Low, THEN Flow is Medium.
- IF Temperature is Cold AND Pressure is High, THEN Flow is Medium.

Show the step-by-step computation with visualizations to determine water flow for a temperature of 32°C and a pressure of 55 PSI. [15M]

5. Assume a waiter agent in a restaurant. The task of the waiter is to attend to the calls of customers at tables and take their orders. Many agents are working in the restaurant and each agent is responsible for a few tables to take orders and serve the dishes. The Customer rates the agent at the end. Write the problem descriptions and task environment for this agent. [5M+5M]

6. Given the following English sentences:

- ✓ Rohan is a smuggler. ✓
- ✓ Ajay is a burglar. ✓
- ✓ A criminal is someone who is either a smuggler or a burglar. ✓
- ✓ Rhea is a detective. ✓
- ✓ Detectives dislike criminals. ✓
- ✓ Criminals collaborate with each other. ✓
- ✓ Criminals are afraid of detectives. ✓
- ✓ Detectives arrest criminals. ✓

- a) Translate these English sentences into First-Order Logic (FOL). [2M]

- b) Write Prolog facts and rules based on the statements. [2M]

- c) Write Prolog queries and determine the results for the following questions: [2M]

- i. Who collaborates with Ajay? [2M]

- ii. Who is afraid of Rhea? [2M]

- iii. Who does Rhea arrest? [2M]

7. How does the perceptron learn and demonstrate the process for logical OR operation with the following assumption values w_1, w_2, θ, α are 0.2, 0.2, -0.1, 0.2. Calculate the value of the weights at the end of the first epoch. [5M+5M]

8. Illustrate the structure of an expert system and explain each component considering an example expert system. [5M+5M]



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM

Department of Computer Science and Engineering

MID SEMESTER EXAMINATION- SEPTEMBER, 2024

COURSE TITLE: CSE 312 Software Engineering and Project Management

Max. Marks: 50

Time: 2.30 to 4 pm

Course Instructor: Dr. Sreeja M. U., Dr. Dhakshayani J, Dr. Sara Renjit

Batch: I, II and III (2022)

Answer all Questions

1. You are designing a discount calculation feature for an online retail platform. The discount applied to a purchase depends on the following conditions: (5)

Membership status: Regular, Silver, or Gold

Purchase amount: Below \$100, between \$100-\$500, or above \$500

Payment method: Credit Card, PayPal, or Gift Card

Draw a decision table/tabular specification that shows how different discounts should be applied based on the membership status, purchase amount, and payment method.

2. List out the metrics for specifying nonfunctional requirements. (5)

3. You are part of a software development team working for a company that wants to launch a new e-commerce website. The website will allow users to browse products, add items to a shopping cart, place orders, and make payments. The stakeholders expect continuous feedback and delivery of working features in short time spans.

- a. Explain how Agile Scrum methodology is suited to this kind of development with respect to the Agile manifesto and also list down the various stakeholders/project roles and their tasks in the team. (5)

- b. Mention the different project deliverables and draw the sprint cycle in terms of this scenario. (5)

4. You are creating a personal finance management app with features such as expense tracking, budgeting, and financial goal setting.

- a. Which development process models would you select? Justify your choice by evaluating aspects such as data security, user personalization, and iterative feature enhancement. (5)

- b. Conduct a feasibility study that assesses the technical, financial, and operational feasibility of implementing this system. (5)

c. What risks might arise in this scenario, and how would you address them? (5)

5. You are designing a bank's Automated Teller Machine (ATM) system. The ATM system is designed to allow customers to perform various banking transactions like cash withdrawals, balance inquiries, deposits, fund transfers, and PIN changes. The system needs to communicate with the bank's central server to validate transactions, ensure security, and log all activities. The ATM system must ensure high availability, operate 24/7, and be user-friendly, offering multi-language support and an accessible interface for different types of users, including those with disabilities. Draft the following as part of SRS document.

- a. User and system requirements (5)
- b. Functional and non-functional requirements (5)
- c. Form-based specifications (5)

Roll No: 2022BCS0019

Name: Ashinav Bhagwat



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

END SEMESTER EXAMINATION - ODD 2024-'25

NOVEMBER 2024

COURSE TITLE: CSE 312 Software Engineering and Project Management

Date and Time: 18/11/2024, 9:30 am to 12:30 pm

Max. Marks: 100

Course Instructor: Dr. Sara Renjit, Dr. Sreeja M. U., Dr. Dhakshayani J.

Batch: 2022(1,2,3)

Answer all questions

Part A (8 marks*5)

1. For the algorithm below, formulate test data for statement, branch and path coverage. (8)

```
def find_max(a, b, c):
    if a >= b and a >= c:
        print("Max is a")
    elif b >= a and b >= c:
        print("Max is b")
    else:
        print("Max is c")
```

2. a. Given a scenario where multiple modules share data directly, identify and explain the type of coupling. (4)

- b. Explain why low coupling and high cohesion are desirable in software design. (4)

3. 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. (8)

4. For a library management system, propose a set of use cases that show the interactions between librarian, student and book allocations. Also draw the sequence diagram for the same. (8)

5. You are the Project Manager for a team developing a new Online Shopping System for a retail company. The system is expected to handle customer orders, payments, inventory management, and product catalogues. The company has set a tight deadline and expects the system to be launched in 6 months. The stakeholders involved include end customers, sales managers, inventory managers, and the marketing department. The company also wants to ensure that the system is scalable, secure, and provides a great user experience.

- a. What SDLC model would you choose for this project? Explain your reasoning for selecting this model. (4)

- b. How would you approach the planning phase? What are the key tasks and project deliverables? (4)

Part B (10 marks*2)

6. Detail the process of Function oriented design and object oriented design for designing a weather prediction system highlighting the major differences in the process. (10)

7. You are a Requirements Engineer for a new project aimed at developing a Hospital Management System (HMS) for a medium-sized hospital. The system needs to handle multiple functionalities, including patient registration, appointment scheduling, billing, medical records management, and staff management. The hospital has provided a general description of what they want the system to do, but the details are unclear. Your task is to gather and define the system's requirements, ensuring that they are comprehensive, accurate, and validated based on Doctors, Nurses, Admin Staff, Patients, and Hospital Management.
- Detail the key steps you will follow in the requirements engineering process for this project? (5)
 - How would you approach requirements elicitation for this system, and what techniques would you use to gather information from the various stakeholders? (5)

Part C (20 marks*2)

8. Interpret the following pseudo code based on what is the input, output and what it performs. Also draw the control flow graph, compute the cyclomatic complexity and formulate test cases for the same. (20)

```
def Algo (array, x, low, high):
    while low <= high:
        mid = low + (high - low)//2
        if x == array[mid]:
            return mid
        elif x > array[mid]:
            low = mid + 1
        else:
            high = mid - 1
    return -1
```

9. Perform the specific black box testing mentioned for the following scenarios.
- You are testing an online registration form for a new user in a social media application. The registration form asks for the following details:
 - ✓ **Username:** The username should be between 5 and 15 characters, containing only letters (a-z, A-Z) and numbers (0-9).
 - ✓ **Password:** The password should be at least 8 characters long and must contain at least one uppercase letter, one lowercase letter, and one numeric digit.
 - ✓ **Age:** The age must be a positive integer and should be between 18 and 100 (inclusive).
 Design test cases for this form using Equivalence Partitioning. (8)
 - You are testing a Bank Account Withdrawal System that allows customers to withdraw money from their bank accounts. The system has the following requirements: The minimum withdrawal amount is \$10, and the maximum withdrawal amount is \$500. The system does not allow a withdrawal if the user tries to withdraw an amount that is less than the minimum or greater than the maximum limit. Perform Boundary Value Analysis to design test case on the withdrawal functionality. (6)
 - Explain orthogonal array testing with an example scenario consisting of three parameters. (6)

Name: Abhinav Bhagwat

Roll No: 2022 BC50019



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM

Department of Computer Science Engineering

MID SEMESTER EXAMINATION- SEPTEMBER, 2024

IMA311: Soft Computing

Date & Time: 24-09-2024, 02:30 PM - 04:00 PM

Max mark: 50

Course Instructor: Dr. Lidiya Lilly Thampi / Dr. Ravi A / Dr. Suriyapriya K

Batch: 2022

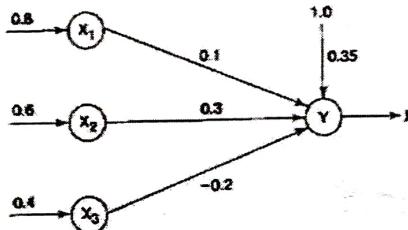
CSE-1, 2, 3

(Scientific Calculators are allowed)

Answer all Questions

1. (a) Obtain the output of the neuron Y for the network shown in Figure 1, using activation functions as: (i) binary sigmoidal and (ii) bipolar sigmoidal.

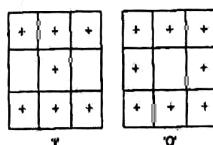
Figure 1:



- ✓ (b) Implement AND function using McCulloch-Pitts neuron (take binary data). [3+7]

- ✓ 2. Using the Hebb rule, find the weights required to perform the following classifications of the given input patterns shown in Figure 2. The pattern is shown as 3×3 matrix form in the squares. The "+" symbol represent the value "1" and empty squares indicate "-1". The pattern "T" has the target value 1 and "O" has the target value -1. Also, obtain the network architecture of the Hebb net for the data matrix. [10]

Figure 2:



- ✓ 3. Use Adaline network to train AND NOT function with bipolar inputs and targets. Perform 2 epochs of training. Assume equal initial weights and bias, say 0.2. The learning rate is set to 0.2. Also, obtain the total mean square error value for 2 epochs and network architecture for AND NOT function using Adaline network. [15]

4. Use outer product rule to store the vectors $[1 \ 1 \ 1 \ 1]$ and $[-1 \ 1 \ 1 \ -1]$ in an autoassociative network.

- (a) Find the weight matrix (do not set the diagonal term to zero).

- (b) Test the vector using $[1 \ 1 \ 1 \ 1]$ as input.

- (c) Test the vector $[-1 \ 1 \ 1 \ -1]$ as input.

- (d) Test the net using $[1 \ 1 \ 1 \ 0]$ as input.

- (e) Repeat (a) to (d) with the diagonal terms in the weight matrix set to zero. [15]

* * * Best wishes * * *

Name: Abhinav Bhagwat

Roll No: 2022BCS0019



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM

Department of Computer Science Engineering

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END SEMESTER EXAMINATION - NOVEMBER, 2024

IMA311: Soft Computing

Date & Time: 25-11-2024, 09:30 A.M to 12:30 P.M

Max mark: 100

Course Instructor: Dr. Lidiya Lilly Thampi / Dr. Ravi A / Dr. Suriyapriya K

Batch: 2022

CSE-1, 2, 3

Calculator is permitted

Answer all Questions

1. Let $A = \frac{0.65}{-2} + \frac{0.6}{-1} + \frac{0.92}{0} + \frac{0.67}{1} + \frac{0.55}{2}$ and $B = \frac{0.95}{-2} + \frac{0.45}{-1} + \frac{0.97}{0} + \frac{0.16}{1} + \frac{0.44}{2}$.
Find the following:

[2]

(a) $\overline{A \cup B}$

[2]

(b) $\overline{A} \cap \overline{B}$

[1]

(c) Support and height of \overline{A} and \overline{B}

[2]

(d) $0.5 A$

[2]

(e) $0.9 + B$

[1]

(f) Height of A and B

[1]

2. Three fuzzy sets are defined as follows: $A = \frac{0.3}{a} + \frac{0.25}{b} + \frac{0.24}{c}$, $B = \frac{0.27}{a} + \frac{0.95}{b} + \frac{0.18}{c}$, $C = \frac{0.53}{a} + \frac{0.32}{b} + \frac{0.5}{c}$.
Find:

[2]

(a) $R = A \times B$

[2]

(b) $S = B \times C$

[2]

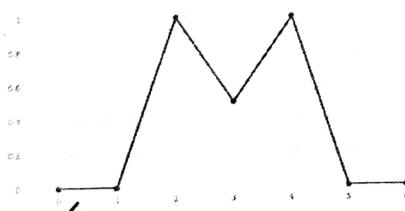
(c) $T = R \circ S$ using Max-min Composition.

[2]

(d) Prove that $R \circ S \neq S \circ R$

[1]

3. For the given fuzzy set, find the defuzzified value using the Centroid method. [10]



4. 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	-

5. 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	0.07
Q	0.07
R	0.07
$P \cup Q$	0.1
$P \cup R$	0.08
$Q \cup R$	0.04
$P \cup Q \cup R$	0.57

6. Using linear separability concept, obtain the response of OR function (take bipolar inputs and bipolar targets). [7]

7. Consider a Counter Propagation Network with input pair $x = [0 \ 1 \ 1 \ 0]$ and $y = [0 \ 1]$. Perform phase I training and find the activation of cluster layer units. Using learning rate $\alpha = 0.2$ and $\beta = 0.3$, update the weights and find the activation of cluster layer units. Sketch the instar model of full CPN. [10]

Given: $v_{11} = v_{21} = v_{32} = v_{42} = 0.7$; $v_{31} = v_{41} = v_{12} = v_{22} = 0.5$; $w_{11} = w_{12} = w_{21} = w_{22} = 0.2$

8. Using the Madaline network, implement the XOR function with bipolar inputs and bipolar targets (1 epoch). The learning rate is 0.5. Use bipolar step function as activation function with $\theta = 0$.

Given parameters: $[w_{11} \ w_{21} \ b_1] = [0.05 \ 0.2 \ 0.3]$; $[w_{12} \ w_{22} \ b_2] = [0.1 \ -0.2 \ 0.15]$; $[v_1 \ v_2 \ b_3] = [0.5 \ 0.5 \ 0.5]$ [16]

9. 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 [12]

$\begin{matrix} * & * & * \\ * & . & . \\ * & * & * \\ * & . & . \\ * & * & * \end{matrix}$	$\begin{matrix} * & * & * \\ * & * & * \\ * & . & . \\ * & . & . \\ * & . & . \end{matrix}$
E	F

10. 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]

11. Fill in the blanks with appropriate answer

- (a) ANFIS stands for _____. [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]
- (e) The advantage of using fuzzy logic in decision making systems is _____. [1]

* * * Best wishes * * *



Roll No:..... 2022 BCS0019

Name:..... Johnor Bhamat

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computational Science and
Humanities

END SEMESTER EXAMINATION - ODD 2024-'25
NOVEMBER 2024

COURSE TITLE: IHS 313 Operations and Supply Chain Management

Time: 9.30 AM-12.30 PM

Max. Marks: 100

Course Instructor: Dr Mathew C D

Batch: 1,2 & 3

Answer All Questions

1 MARK EACH

1. Production is a measure of efficiency
 - a) True
 - b) False
2. When production increases productivity also increases
 - a) True
 - b) False
3. Agile Delivery model is having cross functional small teams
 - a) True
 - b) False
4. Design of best structure to contain all the facilities is the crux of
 - a) Plant layout.
 - b) Process Layout
 - c) Material Handling
 - d) Purchase Management
5. Which one is not part of product design:
 - a) Design and marketing
 - b) Product Development
 - c) Manufacturing
 - d) Productivity
6. Routing may be defined as the selection of path, which each part of the product will follow, which being transformed from raw material to finished products.
 - a) True
 - b) False
7. Scheduling is time oriented
 - a) True
 - b) False
8. Dispatching is 'Release of orders and instruction for the starting of production for any item in acceptance with the Route sheet and Schedule Charts'.
 - a) True
 - b) False
9. Which one is a pro active measure
 - a) Preventive maintenance
 - b) Breakdown maintenance
 - c) all of the above
10. Minimisation of material cost is not an objective of materials management

- a) True
- b) False

11. According to bullwhip effect fluctuation in orders increase as they move up the supply chain but stabilizes later on

- a) True
- b) False

12. Downstream defines everything that comes into your company from suppliers (usually raw materials) whereas upstream defines everything that goes out of your company after the production cycle

- a) True
- b) False

13. Pull: execution is initiated in response to a customer order.

- a) True
- b) False

14. Normal time = Basic time x Rating factor

- a) True
- b) False

15. Following is not part of allowance

- a) Interference allowance
- b) Relaxation allowance
- c) Process allowance
- d) Agitation allowance

16. Which one is not part of a good sample

- a) Representative
- b) Unbiased
- c) Repetitive
- d) Convenient

17. Which one is not part of work sampling

- a) Work sampling can be applied to estimate the machine utilization and resources utilization,
- b) Estimate unavoidable delays in decision making of delay allowances,
- c) Evaluate the time consumed by different activities such as repairs, inspection supervision,
- d) Find out the machine breakdown

18. In EOQ, procurement cost and carrying cost are same

- a) True
- b) False

19. Total Factor Productivity (TFP), relates total output to the sum of associated labor and capital inputs.

- a) True
- b) False

20. Which one is not part of inventory

- a) Raw materials and purchased spare parts.
- b) In-process material which means semi finished goods.
- c) Finished goods which are lying in stock room waiting for dispatch.
- d) Projected Inventory

PART B - 10 MARKS EACH

1. Given, 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 the ordering is \$50 per order.

a. Calculate the number of orders per year?

2. Elaborate work sampling and enumerate the characteristics of a good sample.
3. Is it possible to use software to counter the effect of bullwhip effect in Supply Chain Management? If yes elaborate it

4. Case Study: FreshProduce Ltd.

FreshProduce Ltd. is a company specializing in delivering fresh fruits and vegetables to local grocery stores. The company faced challenges with spoilage and delivery delays, impacting customer satisfaction.

~~Questions~~

~~Q1: What main challenge did FreshProduce Ltd. face?~~

~~Q2: How would a real-time inventory management system help FreshProduce Ltd.?**~~

~~Q3: What advantage does route optimization provide for delivery?~~

~~Q4: Why is minimizing spoilage critical for FreshProduce Ltd.?~~

5. How do demand forecasting methods influence inventory management decisions in supply chains?

6. How can technology, such as AI and IoT, enhance decision-making in supply chain management?

7. In the context of a multinational manufacturing company, how would you approach the integration of demand forecasting and inventory management across multiple global locations? Discuss the challenges and strategies for balancing centralized and decentralized inventory systems, particularly in a volatile market. Also, evaluate the role of advanced analytics and AI in improving demand forecasting accuracy.

8. Discuss the various types of risks that can affect a supply chain (e.g., supply-side, demand-side, geopolitical, financial, and environmental) and propose a framework for managing these risks. How can technology and data analytics be used to predict and mitigate these risks? Consider the implications of disruptions like the COVID-19 pandemic and geopolitical tensions on global supply chains.



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computational Science and Humanities

END SEMESTER EXAMINATION- NOVEMBER, 2024
COURSE TITLE: HIS 311 Human Resource Management

Time: 09.30 am to 12.30 pm

Max. Marks: 100

Course Instructor: Dr. Pradeep S/Jesse Alexander

Batch: I, II and III

Answer all Questions**[SECTION A]****Correct the sentence**

{20*1=20 marks}

- ✓ 1. Preventive machinery promotes peaceful industrial relations by restricting discipline and communication between employers and workers.
- ✓ 2. The employee contribution in India towards Provident Fund is 13% and employer contribution is 11%. Out of the total contribution, 4% goes towards pension fund and 9% goes towards EPF.
- ✓ 3. The Industrial psychology era (1945 to 1970) focused on gaining competitive advantage in market through HR.
- ✓ 4. Staff managers (or HR managers) provide specialized services, advice, and support to line managers. They have direct authority over line employees.
- ✓ 5. HR Business Partner roles focus primarily on administrative tasks.

Fill in the blanks

- ✓ 6. The approach that emphasizes the importance of worker satisfaction, motivation, and leadership is _____
- ✓ 7. The Prevention of Sexual Harassment (POSH) Act came into effect in India in the year _____ and superseded the _____ Guidelines on the same.
- ✓ 8. The entire HR spectrum can be broadly categorised into 3 areas – Talent Acquisition, Talent Development and Talent _____
- ✓ 9. _____ involves identifying, attracting, and selecting individuals who fit the job requirements and the organization's culture.
- ✓ 10. _____ is essential to maintain and improve employees' skills and competencies.
- ✓ 11. A _____ source is a way of finding new employees from outside the organization. Seeking out external hires through job boards, recruiting agencies, and other means can help keep fresh, new talent in the organization.
- ✓ 12. _____ role in HR plays a strategic role in aligning human resource strategies with the business goals of an organization
- ✓ 13. _____ incentives are common in the IT industry and are provided to employees for project completions and new innovations.

Choose the right option

- ✓ 14. The social factors that affect the industrial relations are
- a) Education, Wealth, Class
 - b) Government, Parties, Legal
 - c) Market, Employment, Technology
 - d) Mass, Media
- ✓ 15. Which among the following can help establish cost optimal teams in the organisation?
- I. Hiring more at the bottom of the pyramid
 - II. Creating opportunities for job rotations & promotions
 - III. Recruiting highly and niche skilled workforce, in anticipation of future growth
 - IV. Lining up a set of in-sourcing providers for just-in-time hiring
- a) I & II
 - b) I, II & IV
 - c) I & IV
 - d) I, II, III & IV
- ✓ 16. External recruiting sources exclude
- a) Advertisements
 - b) Campus recruitment
 - c) Job rotation
 - d) Job Boards
- ✓ 17. Which among the following is the disadvantage of external recruitment?
- a) Access to a more diverse talent pool
 - b) Enhanced Diversity
 - c) Filling Skill Gaps
 - d) Longer adjustment period
- ✓ 18. What role does Google's employer brand play in its business strategy?
- a) It only impacts employee retention.
 - b) It strengthens Google's position as a preferred employer worldwide.
 - c) It focuses solely on reducing employee wages.
 - d) It eliminates the need for performance bonuses.
- ✓ 19. To attract the right candidates, job descriptions should include _____.
- a) Clear role expectations
 - b) Company financials
 - c) Termination Criteria
 - d) Recruitment budget
- ✓ 20. What should the organizations consider when deciding between internal and external recruitment methods?
- a) Diversity strategies
 - b) Resource availability
 - c) Hiring timelines
 - d) All of the above

[SECTION B]

Answer all the questions briefly

{ $10 \times 2 = 20$ marks}

1. Explain the various forms of industrial disputes.
2. Describe the different sources of grievance.
3. An organisation has a total attrition rate of 24% out of which 8% is regretted attrition and the balance is unregretted. The new joiner retention ratio is 75% as against a target of 95%. What are your inferences from the data given?
4. Explain the importance of a career development framework in talent acquisition and talent management?
5. Explain the different sources of external recruitment
6. Mention briefly about challenges of HRM in the IT Industry
7. What are the key responsibilities of HR Business Partners?
8. Mention the characteristics of HR practices in Industrial Revolution (1820 to 1840).
9. What is Wage and Salary Administration?
10. What are performance-based incentives, and why are they used in IT?

[SECTION C]

Answer all the questions

{ $6 \times 5 = 30$ marks}

1. Mention the steps in grievance procedure.
2. What are the 3 primary questions that have to be answered (or the 3 primary objectives) of a selection process?
 3. How do you ensure that these 3 are covered during the selection process?
 4. Which is the methodology that differentiates the types of questions based on the levels of assessment in the job hierarchy?
5. What do you understand by Behavioural Event Interviewing?
6. Elucidate the qualities of HR managers? *(CT, CS, PS, TB)*
7. Mention briefly about the Career path of HR Managers
8. Mention briefly about the various theories prevailed Evolution of HRM
9. Explain the objectives of Quality circles in Total Quality Management.

[SECTION D]

Answer Any 2 of the following

{ $2 \times 15 = 30$ marks}

- (1) With reference to Human Resources; Write any 3 metrics from each of the following categories

Talent Acquisition; Talent Engagement; Financial

Also, Define

- a. If they are a lead or lag indicator
- b. How are they measured?
- c. What does a high or low number against these metrics imply?
- d. What can be further inspected based on the metric and what decision can the leadership take based on the implications?

(2) ZY Tech, a mid-sized software company, is looking to fill a senior software engineer position. The HR department is debating between sourcing candidates internally and externally. The company has a strong internal talent pool with a few qualified engineers who could be promoted or moved laterally. However, the leadership team is considering external candidates to bring in new perspectives and specialized skills that might not currently exist within the company.

Answer the following-

- a. What are the potential advantages and disadvantages of sourcing candidates internally for this role?
- b. What are the potential benefits and challenges of hiring externally for this position?
- c. If you were the HR manager at ZY Tech, which approach would you recommend for filling this senior software engineer role? Justify your answer by considering factors like company culture, innovation, and cost.

(3) AdventTech Solutions, a rapidly expanding software development firm, has experienced substantial growth over the past few years. Despite its success, the company has been facing significant challenges with employee retention, particularly within its technical teams. Several exit interviews have highlighted dissatisfaction with compensation levels, lack of recognition, and limited opportunities for career advancement as the primary reasons for employee turnover.

The HR team has been tasked with addressing these issues by revising the company's wage and salary strategy to improve employee retention and satisfaction. The leadership team is considering two distinct approaches to adjust compensation and benefits packages for their employees:

Approach I	Increase base salaries across all technical teams to align with industry standards
Approach II	Introduce a flexible, performance-based compensation model that combines base salary increases, performance bonuses, profit-sharing schemes, and enhanced benefits (such as health and wellness programs, paid time off, and educational allowances)

Answer the following-

- a. What are the potential advantages and disadvantages of increasing base salaries across all technical teams to align with industry standards?
- b. What are the potential benefits and challenges of introducing a flexible, performance-based compensation model that combines salary increases, bonuses, profit-sharing, and benefits?
- c. If you were the HR Manager at Advent Tech Solutions, which approach would you recommend and why? Consider factors such as employee motivation, financial sustainability, company culture, and competitiveness in the tech industry.

END SEM EXAMINATION- ODD 2024-25
COURSE TITLE: IHS 312 Financial Management and Accounting

Time: 9.30 am-12.30 pm

Max. Marks: 100

Course Instructor: Dr Raghunadhan T

Batch: I, II & III

Answer all Questions

Part A

(This section contains 30 MCQs. Answer all Questions/ No negative marks for wrong answers. Answer the MCQs in the first page of Answer sheet itself)

Total marks: 30

Marks each question carries: 1 mark each

1. Which of the following represents the time value of money?

- a) Future value
- b) Present value
- c) Net present value
- d) All of the above

2. 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

3. In the context of capital budgeting, the term 'cash flows' refers to:

- a) Revenue only
- b) Inflows and outflows of cash
- c) Profits
- d) Total Sales

4. The formula for the Weighted Average Cost of Capital (WACC) includes

- a) Cost of equity and cost of debt
- b) Cost of equity only
- c) Cost of debt only
- d) Total revenue

5. Which of the following is a key assumption of the Capital Asset Pricing Model (CAPM)?

- a) Investors have irrational behaviour
- b) Markets are inefficient
- c) Investors are risk-averse
- d) All investors have different expectations

✓ 6. The Net Present Value (NPV) rule states that:

- a) Projects with positive NPV should be accepted
- b) Projects with negative NPV should be accepted
- c) NPV has no impact on investment decisions
- d) Only NPV equal to zero is acceptable

✓ 7. An increase in dividend pay-out ratio generally:

- a) Increases retained earnings
- b) Decreases retained earnings
- c) Has no effect on retained earnings
- d) Decreases cash reserves

✓ 8. The primary purpose of cash management is to:

- a) Increase sales
- b) Minimize cash holdings
- c) Ensure liquidity
- d) Maximize profits

✓ 9. A higher payback period indicates:

- a) Faster recovery of investment
- b) Greater risk
- c) Lower profitability
- d) All of the above

✓ 10. The primary source of financing for most businesses is:

- a) Equity
- b) Debt
- c) Retained earnings
- d) Grants

✓ 11. Which of the following factors does NOT directly influence dividend policy?

- a) Profitability
- b) Cash flow
- c) Retained earnings
- d) Market share

✓ 12. Which of the following is a common method for estimating the cost of equity?

- a) Dividend Discount Model
- b) Weighted Average Cost of Capital
- c) Capital Asset Pricing Model
- d) Both a and c

✓ 13. Which financial ratio measures the efficiency of a company in using its assets to generate earnings?

- a) Current ratio
- b) Return on Assets (ROA)
- c) Debt to Equity ratio
- d) Price to Earnings ratio

✓ 14. The cash conversion cycle consists of which components?

- a) Inventory turnover, accounts payable, accounts receivable
- b) Inventory turnover, accounts receivable, cash flow
- c) Accounts payable, cash flow, profit margin
- d) Inventory turnover, accounts payable, sales

15. The cost of debt is typically:

- a) Higher than the cost of equity
- b) Lower than the cost of equity
- c) Equal to the cost of equity
- d) Independent of tax rates

16. A company with a high dividend pay-out ratio is likely to:

- a) Retain less earnings for growth
- b) Have high retained earnings
- c) Increase future dividends
- d) None of the above

17. Which of the following is an example of an investment decision?

- a) Deciding to issue bonds
- b) Allocating funds for new equipment
- c) Paying dividends
- d) Managing working capital

18. An increase in accounts receivable indicates that:

- a) The company is collecting cash faster
- b) Sales are increasing
- c) The company is extending more credit
- d) Both b and c

19. The primary purpose of a budget is to:

- a) Control expenses
- b) Increase revenues
- c) Plan future operations
- d) Evaluate past performance

20. The profitability index is calculated as:

- a) NPV / Cost of investment
- b) Cash inflows / Cash outflows
- c) Present value of future cash flows / Initial investment
- d) Net income / Shareholders' equity

21. Which of the following financial statements provides information about cash inflows and outflows?

- a) Income statement
- b) Balance sheet
- c) Cash flow statement
- d) Statement of changes in equity

22. The return on equity (ROE) measures:

- a) How effectively a company is using its debt
- b) The profitability of a firm relative to its equity
- c) The return generated on total assets
- d) The total income generated by the company

23. The cost of equity can be estimated using:

- a) Historical returns
- b) Dividend growth model
- c) Both a and b
- d) None of the above

24. A company with a lower debt-to-equity ratio is generally considered:

- a) More risky
- b) Less risky
- c) More profitable
- d) Less efficient

25. A cash budget is primarily used for:

- a) Planning future sales
- b) Forecasting cash inflows and outflows
- c) Determining inventory levels
- d) Evaluating financial performance

26. 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:

- a) D,C,A,E,B
- b) B,A,D,E,C
- c) A,B,C,E,D
- d) D,E,A,B,C

27. You plan to receive Rs 5,000 in 3 years. If the annual discount rate is 5%, what is the present value of that future amount?

Options:

- A) Rs 4,329.48
- B) Rs 4,500.00
- C) Rs 3,850.00
- D) Rs 4,000.00

28. A company is considering two investment projects, A and B. The projected cash flows for each project are as follows:

- Project A:
 - Initial Investment: Rs 50,000
 - Cash Flows:
 - Year 1: Rs 20,000
 - Year 2: Rs 25,000
 - Year 3: Rs 30,000
- Project B:
 - Initial Investment: Rs 50,000
 - Cash Flows:
 - Year 1: Rs 15,000
 - Year 2: Rs 30,000
 - Year 3: Rs 40,000

If the company uses a discount rate of 10%, which project should the company choose based on the Net Present Value (NPV) method?

Options:

- A) Project A
- B) Project B
- C) Both projects are equal
- D) Neither project is viable

✓ 29. A company has the following information regarding its capital structure:

- Cost of equity: 10%
- Cost of debt: 5%
- Proportion of equity in the capital structure: 70%
- Proportion of debt in the capital structure: 30%

What is the company's weighted average cost of capital (WACC)?

- A) 6.5%
- B) 7.0%
- C) 8.0%
- D) 8.5%

✓ 30. A company is considering an investment of Rs 20,000 in new equipment. The expected cash inflows from the equipment are as follows:

- Year 1: Rs 8,000
- Year 2: Rs 7,000
- Year 3: Rs 6,000

What is the payback period for this investment?

2.83

Options:

- A) 2.5 years
- B) 3 years
- C) 3.5 years
- D) 4 years

wrong

Part B

Answer all Questions

[Descriptive type Questions/Problems]

(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)

Total marks: 30

Marks each question carries: 5

✓ 31. Explain the concept of the Time Value of Money.

✓ 32. Discuss the significance of capital budgeting in financial management.

✓ 33.
✓ 34.

What factors influence a company's dividend policy?

A company has the following information for the year:

- Inventory at the beginning of the year: Rs. 50,000
- Inventory at the end of the year: Rs 70,000
- Cost of Goods Sold (COGS): Rs 400,000
- Accounts Receivable at the beginning of the year: Rs 30,000
- Accounts Receivable at the end of the year: Rs 50,000
- Sales Revenue: Rs 600,000

Questions:

- a) Calculate the Average Inventory.
- b) Calculate the Inventory Turnover Ratio.
- c) Calculate the Days Inventory Outstanding (DIO).
- d) Calculate the Average Accounts Receivable.
- e) Calculate the Accounts Receivable Turnover Ratio.
- f) Calculate the Days Sales Outstanding (DSO).
- g) Calculate the Operating Cycle.

✓ 35.

A company is planning to invest in a new project requiring an initial investment of Rs.1,000,000. The company's cost of debt is 6%, the cost of equity is 10%, and the debt-to-equity ratio is 1:1. What is the company's weighted average cost of capital (WACC)?

✓ 36.

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.

Part C Answer all Questions

[Descriptive Questions/Problems]

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)

Total marks: 40

Marks each question carries: 10

✓ 37. Case Study:

XYZ Ltd. is a mid-sized manufacturing company that produces industrial machinery. Over the past few years, the company has been expanding its operations, increasing its market share, and diversifying its product range. However, the company has recently encountered some financial challenges. Its sales have grown, but so have its operational costs, leading to a decline in profitability. The management team is concerned about the company's cash flow, working capital, and overall financial health.

The company has a debt-equity ratio of 1:1, and it is contemplating taking on more debt to fund an expansion project. The financial manager is tasked with making decisions regarding the financing, investment, and dividend distribution for the next fiscal year. The company has also been considering ways to improve its working capital management, given the tightening liquidity situation.

Tasks:

- ✓ a) Explain the role of financial management in addressing XYZ Ltd.'s financial challenges.
- b) What financial ratios and indicators should the financial manager analyze to assess the company's financial health?
- c) Based on the company's situation, should XYZ Ltd. opt for debt financing for the expansion, or should it explore other financing options? Justify your recommendation.
- d) What measures can XYZ Ltd. take to improve its working capital management?

38. A) Explain the concept of the Weighted Average Cost of Capital (WACC)?

B) A company has the following capital structure:

- Market value of equity = Rs 10 million
- Market value of debt = Rs 5 million
- The cost of equity = 12%
- The cost of debt = 6%
- The corporate tax rate = 30%

Calculate the WACC.

✓ 39. A) Explain the concept of dividend decisions in corporate finance, and solve a related problem illustrating the impact of different dividend policies. Consider the following scenario:

B) Company X has net earnings of Rs 1,000,000 for the year. The company has the following information:

- It has 100,000 shares outstanding.
- The company follows a residual dividend policy.
- The company has identified investment opportunities that require Rs. 600,000 in capital.
- The company's target capital structure is 60% equity and 40% debt.
- The company expects to finance its capital expenditures using a combination of equity and debt in the target proportions.

Calculate the dividend per share that Company X will pay if it follows a residual dividend policy

✓ 40. 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?

=====END=====