NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-15
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
B.TECH. DEGREE, V SEMESTER, I CYCLE TEST, SEP-2023
CSPC52 - Database Management and Systems

DATE: 11-09-2023 **TIME: 11.00 a.m. – 12.00 p.m.** **MAX.MARKS:20 marks**

Answer all Questions **5 x 4 =20 marks**

1. Describe the Database architecture with a neat diagram. Explain the functions of the query processor and storage management components in detail.

2. Consider the following relational database
   employee (person_name, street, city)
   works (person_name, company_name, salary)
   company (company_name, city)
   Give an expression in the relational algebra to express each of the following queries:
   a. Find the names of all employees who lives in the city "Tiruchirappalli".
   b. Find the names of all employees whose salary is greater than Rs. 100,000.
   c. Find the names of all employees who live in "Tiruchirappalli" and whose salary is greater than Rs. 100,000.

3. Design an online Employee information system for using Python and MySQL.
   Employee (Emp_id, name, age, designation, DOJ).
   Implement insertion details module.

4. Describe the different types of join types and conditions for the following relations briefly with examples using the following relations
   Customers (customer_id, name, address, city)
   Orders (order_id, amount, customer_id)
   - Inner join
   - Left join
   - Right join
   - Full outer join.

5. Construct an E-R diagram for an airline. The database must keep track of customers and their reservations, flights and their status, seat assignments on individual flights, and the schedule and routing of future flights. Convert the E-R diagram into a set of relations to represent a strong entity, weak entity, relationship set and multivalued attributes.

----------Best Wishes----------

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-15
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
B.TECH. DEGREE, V SEMESTER, II CYCLE TEST, NOV-2023
CSPC52 - Database Management and Systems

DATE: 06-11-2023 TIME: 11.00 a.m. – 12.00 p.m. MAX.MARKS:20 marks

Answer all Questions 5 x 4 =20 marks

1. Suppose that we decompose the schema r (A, B, C, D, E) into
   r1(A, B, C)
   r2(A, D, E)
   and the following set of functional dependencies holds:
   $A \rightarrow BC$
   $CD \rightarrow E$
   $B \rightarrow D$
   $E \rightarrow A$
   Check the type of decomposition and if dependency is preserved in the decomposition

2. Write Short notes on Fourth Normal Form and Boyce-Codd Normal Form with examples

3. Explain recoverable and non - recoverable schedule with an example

4. Create a student's collections in MongoDB and perform insertion, updating and querying of student details from the document. Use Projections for selecting only necessary data from the student document.

5. Consider the following set F of functional dependencies on the relation schema r (A, B, C, D, E, F):
   $A \rightarrow BCD$
   $BC \rightarrow DE$
   $B \rightarrow D$
   $D \rightarrow A$
   a. Compute B+.
   b. Prove (using Armstrong's axioms) that AF is a super key.
   c. Compute a canonical cover for the above set of functional dependencies give each step of your derivation with an explanation.
   d. Give a 3NF decomposition of r based on the canonical cover.

----------Best Wishes----------

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-15
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
B.Tech. DEGREE, V SEMESTER EXAM, DECEMBER- 2023
CSPC52 - Database Management and Systems

DATE: 05-12-2023 TIME: 10:00 a.m. - 01:00 p.m. MAX.MARKS:100 marks

5 x 20 =100 marks

Answer all Questions

1. **a.** Explain the difference between two-tier and three-tier Database System architectures. Which is better suited for Web applications? Why?
   b. write short notes on client server database architecture.

2. Consider the following relations
   Customer (customer id, customer name, phone, address)
   Orders (order id, customer id, purchase date)
   Orderdetails (Order id, product id, quantity)
   Products (product id, product name, price)
   - Write a ~~function~~ procedure to display the purchase details of a given customer id. The output should have the following fields: customer id, customer name, order id, purchase date, product name, price, quantity, total price
   - Create a ~~procedure~~ function to display the total amount for which the given customer id has purchased, between 10/11/2023 and 04/12/2023.
   - Create a trigger that whenever an insert or update operation occurs on the Products table, a row is added to the Products log table

3. **a.** Find the minimal canonical cover or irreducible set from the following functional dependencies.
   AB→CD
   B→C
   BC→D
   CD→EF
   E→F
   b. Compare and contrast Boyce Code Normal Form with 3NF.

4. **a.** Consider a simplified banking system. Let T0 be a transaction that transfers $100 from account A to account B. Let T1 be a transaction that withdraws $200 from account C. The initial values of accounts A, B and C are $1000, $2000 and $3000 respectively. Use Log based recovery scheme to explain how to recover from the system crash during the execution of the transactions.

   b. Explain lock base protocol used for concurrent execution of transactions briefly?

5. **a.** Explain static hashing and dynamic hashing techniques with examples.
   b. Explain the different categories of NoSQL databases.

----------Best Wishes----------

National Institute of Technology, Tiruchirappalli

Department of Computer Science and Engineering

CYCLE TEST – I

CSPC51 –Computer Architecture

Branch/Semester/ Section	: CSE/ V/A	Time	: 03:00 to 4:00 pm
Date	: 08.09.2023	Max Marks	: 15

1. In a server farm such as that used by Amazon or eBay, a single failure does not cause the entire system to crash. Instead, it will reduce the number of requests that can be satisfied at any one time. If a company has 10,000 computers, each with an MTTF of 35 days, and it experience catastrophic failure only if 1/3 of the computers fail, what is the MTTF for the system? **(2)**

2. Your company has just bought a new 22 core processor, and you have been tasked with optimizing your software for this processor. You will run four applications on this system, but the resource requirements are not equal. Assume the system and application characteristics listed in the table below:

Application	A	B	C	D
% resources needed	41	27	18	14
% resources parallelizable	50	80	60	90

The percentage of resources of assuming they are all run in serial. Assume that when you parallelize a portion of the program by X, the speedup for that portion is X. **(4)**

   a) How much speedup would result from running application A on the entire 22-core processor, as compared to running it serially?
   b) Given that application A requires 41% of the resources, if we statically assign it 41% ofthe cores, what is the overall speedup if A is run parallelized but everything else is runserially?

3. The stage delays in a 4 stage pipeline are 800, 500, 400 and 300 picoseconds. The first stage is replaced with a functionally equivalent design involving two stages with respective delays 600 and 350 picoseconds. What is the throughput increase (in %) of the pipeline? **(4)**

4. What are the different types of hazards in pipelining, and how do these hazards impact the overall performance of pipelined processor? **(2)**

5. There is a 5 stage processor having the stages Instruction Fetch (IF), Instruction Decode (ID), Operand Fetch (OF), Execute (EX) and Write Operand (WO). The EX stage takes 1 clock cycle for ADD and SUB instructions, 3 clock cycles for MUL instruction, and 6 clock cycles for DIV instruction. Operand forwarding is used in the pipeline (for data dependency, OF stage of the dependent instruction can be executed only). If the phases- IF, ID, OF, and WO stages take 1 clock cycle then what is the number of clock cycles taken to complete the following sequence of instructions? **(3)**

I0 : MUL R2 ,R0 ,R1
I1 : DIV R5 ,R3 ,R4
I2 : ADD R2 ,R5 ,R2 ;
I3 : SUB R5 ,R2 ,R6

**********Best Wishes**********

National Institute of Technology, Tiruchirappalli

Department of Computer Science and Engineering

CYCLE TEST – II

CSPC51 – Computer Architecture

Branch/Semester/ Section: CSE/ V/ A Time : 3:00 to 4:00 pm

Date : 03.11.2023 Max Marks : 15

Answer All Questions

1. The following loop is the so-called DAXPY loop (double-precision aX plus Y) and is the central operation in Gaussian elimination. The following code implements the DAXPY operation, $Y = aX + Y$, for a vector length 100. Initially, R1 is set to the base address of array X and R2 is set to the base address of Y: **[4]**

```
        DADDIU  R4,R1,#800  ; R1 = upper bound for X
foo:    L.D     F2,0(R1)    ; (F2) = X(i)
        MUL.D   F4,F2,F0    ; (F4) = a*X(i)
        L.D     F6,0(R2)    ; (F6) = Y(i)
        ADD.D   F6,F4,F6    ; (F6) = a*X(i) + Y(i)
        S.D     F6,0(R2)    ; Y(i) = a*X(i) + Y(i)
        DADDIU  R1,R1,#8    ; increment X index
        DADDIU  R2,R2,#8    ; increment Y index
        DSLTU   R3,R1,R4    ; test: continue loop?
        BNEZ    R3,foo      ; loop if needed
```

Assume the functional unit latencies as shown in the table below. Assume a one cycle delayed branch that resolves in the ID stage. Assume that results are fully bypassed.

Instruction producing result	Instruction using result	Latency in clock cycles
FP multiply	FP ALU op	6
FP add	FP ALU op	4
FP multiply	FP store	5
FP add	FP store	4
Integer operations and all loads	Any	2

Assume a single-issue pipeline. Unroll the loop as many times as necessary to schedule it without any stalls, collapsing the loop overhead instructions. How many times must the loop be unrolled? Show the instruction schedule. What is the execution time per element of the result?

2. Consider the following program code. What are the contents of ROB at the time when we have issued all the instructions in the loop twice? Let's also assume that the L.D and MUL.D from the first iteration have committed and all other instructions have completed execution. [3]

```
Loop: L.D F0,0(R1)          ;F0=array element
      ADD.D F4,F0,F2        ;add scalar in F2
      S.D F4,0(R1)          ;store result
      DADDUI R1,R1,#-8      ;decrement pointer;8 bytes (per DW)
      BNE R1,R2,Loop        ;branch R1!=R2
```

3. Consider the usage of critical word first and early restart on L2 cache misses. Assume a 1 MB L2 cache with 64 byte blocks and a refill path thatis 16 bytes wide. Assume that the L2 can be written with 16 bytes every 4 processor cycles, the time to receive the first 16 byte block from the memory controller is 120 cycles, each additional 16 byte block from main memory requires 16 cycles, and data can be bypassed directly into the read port of the L2 cache. Ignore any cycles to transfer the miss request to the L2 cache and the requested data to the L1 cache.How many cycles would it take to service an L2 cache miss with and without critical word first and early restart? [3]

4. A 8-way set associative cache memory unit with a capacity of 32 KB is built using a block size of 8 words. The word length is 32 bits. The size of the physical address space is 64B. What is the number of bits for the TAG field? [3]

5. a) Which cache configuration, blocking or non-blocking, offers superior memory performance? Justify your answer.
   b) Between hardware prefetching and compiler prefetching, which one is more likely to increase memory access time? [2]

N/W

**********Best Wishes*********

National Institute of Technology, Tiruchirappalli
Department of Computer Science and Engineering

End Semester

CSPC31 – Computer Architecture

Branch/Semester/ Section : CSE/ V/ A

Time : 10:00AM to 01:00 PM Max Marks: 50

Date : 11.12.2023

Answer All Questions

1.

a) Let there are two operations to be performed: one is a product of 3 scalar variables, and one is a matrix sum of a pair of two-dimensional arrays, with dimensions 9 by 9.

For now let's assume only the matrix sum is parallelizable;

i. What speed-up do you get with 10 versus 40 processors? **3**

ii. Calculate the speed-ups assuming the matrices grow to 20 by 20. **3**

b) You are designing a system for a real-time application in which specific deadlines must be met. Finishing the computation faster gains nothing. You find that your system can execute the necessary code, in the worst case, **4**
twice as fast as necessary.

a) How much energy do you save if you execute at the current speed and turn off the system when the computation is complete?

b) How much energy do you save if you set the voltage and frequency to be half as much?

2.

a) The average memory access time for a microprocessor with 1 level of cache is 2.4 clock cycles

- If data is present and valid in the cache, it can be found in 1 clock cycle
- If data is not found in the cache, 80 clock cycles are needed to get it from off-chip memory Designers are trying to improve the average memory access time to obtain a 65% improvement in average memory access time, and are considering adding a 2nd level of cache on-chip.
- This second level of cache could be accessed in 6 clock cycles
- The addition of this cache does not affect the first level cache's access patterns or hit times - Off-chip accesses would still require 80 additional CCs.

To obtain the desired speedup, how often must data be found in the 2nd level cache? **6**

b) Consider a cache with a line size of 32 bytes and a main memory that requires 30 ns to transfer a 4-byte word. For any line that is written at least once before being swapped out of the cache, what is the average number of times that the line must be written before being swapped out for a write-back cache to be more efficient that a write-through cache? How does the answer change if the main memory uses a block transfer capability that has a firstword access time of 30 ns and an access time of 5 ns for each word thereafter? **4**

3.

a. Identify the RAW, WAR, and WAW dependencies in the following instruction sequence: **4**

I1: R1 = 100
I2: R1 = R2 + R4
I3: R2 = R4 – 25
I4: R4 = R1 + R3
I5: R1 = R1 + 30

R2 = R4 – 25

b. Assume a five-stage single-pipeline microarchitecture (fetch, decode, execute, memory, writeback) and the code below. All ops are one cycle except LW and SW, which are 1 + 2 cycles, and branches, which are 1 + 1 cycles. There is no forwarding. Show the phases of each instruction per clock cycle for one iteration of the loop. How many clock cycles per loop iteration are lost **6**

to branch overhead?

```
Loop:   LW R3,0(R0)
        LW R1,0(R3)
        ADDI R1,R1,#1
        SUB R4,R3,R2
        SW R1,0(R3)
        BNZ R4, Loop
```

4.

a. Distinguish between static scheduling and dynamic scheduling.

b. Name three major techniques that can reduce control hazard stalls? Explain

c. How is the Tomasulo's algorithm modified to include speculation? What are the additional hardware required? **2+3+5**

5.

a) Assume a hypothetical GPU with the following characteristics: 4

- Clock rate 1.5 GHz
- Contains 16 SIMD processors, each containing 16 single-precision floatingpoint units
- Has 100 GB/sec off-chip memory bandwidth

Without considering memory bandwidth, what is the peak single-precision floating-point throughput for this GPU in GLFOP/sec, assuming that all memory latencies can be hidden? Is this throughput sustainable given the memory bandwidth limitation?

b) With multicore processors, the coherence among the processor cores is all implemented on chip, using either a snooping or simple central directory protocol. Which cache coherence protocol does Intel i7 use? Explain. 2

c) There are many extensions of this basic three state cache coherence protocol, one of the most common extensions is MESI. The MESI protocol has four states. What is the advantage of adding this fourth state and how does the protocol solve cache coherence problem? Explain transition of states with example. 4

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NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-620015
B.TECH. DEGREE (FIFTH SEMESTER)
BRANCH: COMPUTER SCIENCE AND ENGINEERING
ASSESSMENT 1
SUB.CODE & TITLE: CSPC53 COMPUTER NETWORKS

TIME: 11.00 A.M.- 12.00 NOON DATE: 07.09.2023 MAX. MARKS: 20

ANSWER ALL QUESTIONS

1. Differentiate: i) Client Server Model and Peer to Peer Model.
   ii) Asynchronous and Synchronous Transmission
2. What is a connectionless service? What are the primitives that are needed for implementing a connectionless service?
3. Explain how switch reduces the traffic on each network link.
4. What is the use of bridge port in transparent spanning tree bridge?
5. What are the causes of distortion?
6. Why a low pass channel is used in baseband transmission? (6 * 2 = 12)
7. What are the functions of i) physical layer and ii) session layer? (3)
8. Assume a multilevel 2B1T is used in Line encoding. Following transition table is used for sending signal and the original level is negative.

Next bits	Previous level positive	Previous level negative
00	+ 5	-5
01	0	0
10	0	0
11	-5	+5

Draw the timing diagram for the transmission of 1101100011011000 (5)

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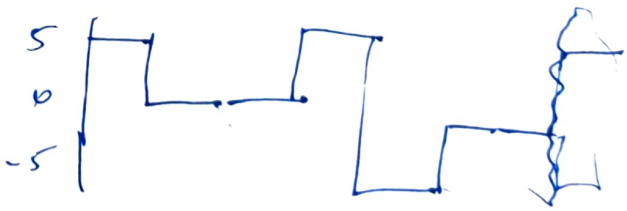


NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-620015
B.TECH. DEGREE (FIFTH SEMESTER)
BRANCH: COMPUTER SCIENCE AND ENGINEERING
ASSESSMENT 3
SUB.CODE & TITLE: CSPC53 COMPUTER NETWORKKS

TIME: 11.00 A.M. TO 12 NOON. DATE: 2.11.2023 MAX. MARKS: 20

CO1 - Gain insight about basic network theory and layered communication architectures

CO2 - Propose algorithms at the appropriate layer for any communication network task

CO3 - Provide solutions to various problems in network theory

CO4 - Conceptualize and design a network stack

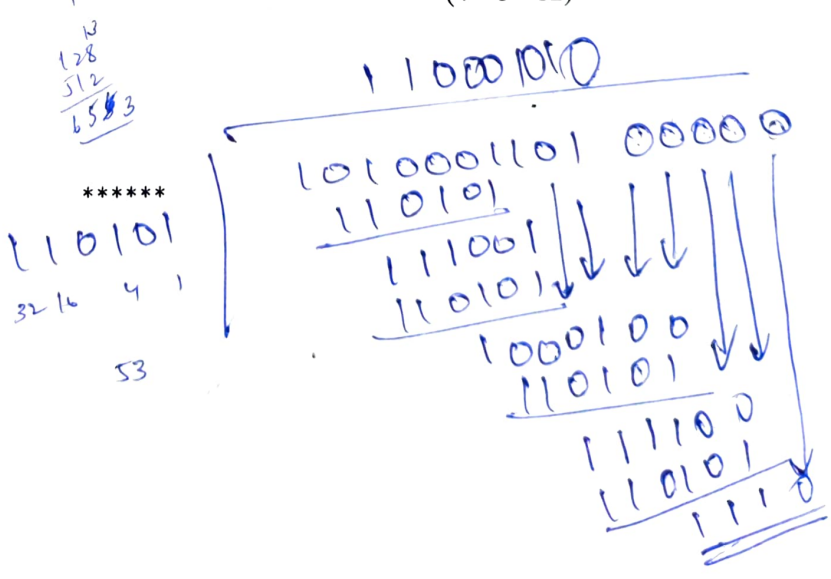
ANSWER ALL QUESTIONS

1. Why synchronous transmission fails in real time audio- video transmission?
2. What is the need of voltage-controlled oscillator in implementing binary frequency shift keying?
3. In statistical time division multiplexing, time slots are wasted. Is it true or false, state reason?
4. What are the uses of the following inter frame spaces: i) SIFS ii) DIFS?

(4 * 2 = 8)

5. Draw the flow diagram of CSMA/CD.
6. What are the different ways of reassembling fragments? What are the various solutions to deal with reassembly failures?
7. Consider the Message M = 1010001101 and the polynomial used for calculating check bits is $X^5+X^4+X^2+1$. Find out the message that is sent by the sender
8. Consider a block of addresses is granted to a small organization. Find out the subnet starting address, subnet last address and the number of addresses if the given IP address is 192.168.0.10/24.

(4 * 3= 12)



NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-620015
B.TECH. DEGREE FIFTH SEMESTER
END SEMESTER EXAMINATION
SPECIALIZATION: COMPUTER SCIENCE & ENGINEERING
SUB.CODE & TITLE: CSPC53 COMPUTER NETWORKS

TIME: 10.00 AM – 1.00 PM DATE: 04.12.2023 MAX. MARKS: 100

CO1 - Gain insight about basic network theory and layered communication architectures

CO2 - Propose algorithms at the appropriate layer for any communication network task

CO3 - Provide solutions to various problems in network theory

CO4 - Conceptualize and design a network stack

ANSWER ALL QUESTIONS

1a) Compare: i) Hub and Switch; ii) Router and Gateway.

b) What are the features provided by layering in Network design? What are the layers in ISO-OSI model? What are their functions? How the layers are grouped based on different criteria?

c) What are the features of Mesh topology and Ring topology? Supposing n devices are to be connected as a network and if the cost of cabling should be less, suggest a topology.

(6, 7, 7)

2a) Differentiate: Baseband Transmission and Broadband transmission. Explain how digital signals are transmitted in both transmissions using a diagram.

b) Explain how analog to digital conversion takes place using PCM encoder.

c) In packets switching, what are the design issues to be considered while transmitting packets?

(7, 7, 6)

3a) Give the frame structure of HDLC. Explain the operation of HDLC using a diagram.

b) Describe the design procedure of Stop and Wait and Sliding Window protocols.

c) Explain the working of p-persistent CSMA protocol. (7, 7, 6)

4a) A datagram of size 3500 bytes had arrived at Router R1. The link to Router R2 has an MTU size of 1000 bytes. The datagram is to reach the destination from R2 through a link of MTU size 600 bytes. How many fragments reach the destination?

b) Demonstrate the working of Protocol Independent Multicast protocol.

c) What is classful addressing? What are its types? Explain how an address of a host is detected using an example. (6, 6, 8)

5a) Draw the diagram for the following:

i) Connection Establishment

ii) Half close

iii) Deny a connection

b) Demonstrate the use of User Agent and Message transfer agent in sending an email. (12, 8)

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National Institute of Technology, Tiruchirappalli - 15
Department of Computer Science and Engineering

Cycle Test 1

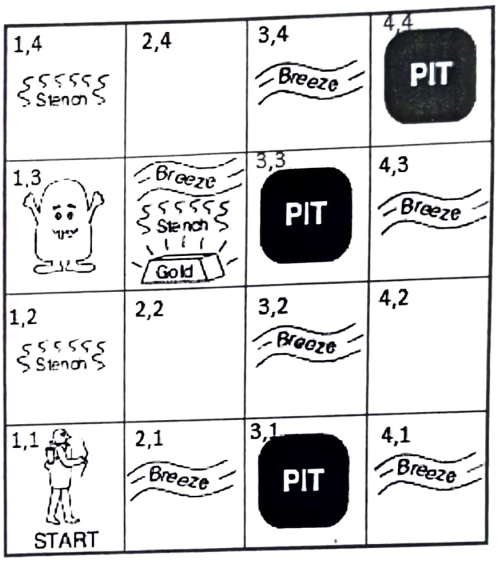
CSPC54 – Introduction to Artificial Intelligence and Machine learning

Course/Department : B.Tech./CSE
Semester/Section : V A
Date and Time : 11-09-2023 & 03.00 PM – 04.00 PM
Batch : 2021-2025
Session : July/2023
Marks : 15

Answer ALL Questions with proper steps and justification.
Draw diagrams wherever necessary.

1. With the help of a diagram discuss on goal-based agent. **(2)** CO2

2. Consider the Wumpus world where the KB consists of the following rules. Prove that Wumpus is inside the room (1,3). Update the KB with facts upon receiving new percepts from the rooms visited. Initial position of the agent and other percept details which you can sense upon visiting rooms are shown in the figure. Visit rooms in the order (1, 1), (2, 1), (1, 1) and (1, 2) to arrive at conclusion. **(3)** CO3



$R1: \neg S_{11} \rightarrow \neg W_{11} \wedge \neg W_{12} \wedge \neg W_{21}$
$R2: \neg S_{21} \rightarrow \neg W_{11} \wedge \neg W_{21} \wedge \neg W_{22} \wedge \neg W_{31}$
$R3: \neg S_{12} \rightarrow \neg W_{11} \wedge \neg W_{12} \wedge \neg W_{22} \wedge \neg W_{13}$
$R4: S_{12} \rightarrow W_{11} \vee W_{12} \vee W_{22} \wedge W_{13}$

3. Give the PEAS description of the task environment for online book shopping agent. **(2)** CO2

4. Let *P: Anil comes to the school trip*, *Q: John comes to the school trip*, *R: Raj comes to the school trip*, and *S: Susan comes to the school trip*. Formalize the following sentences in Propositional logic. **(2)** CO3

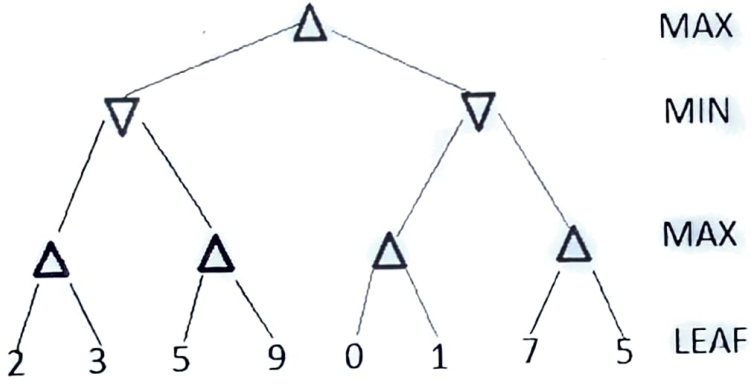
   a) Raj comes to the school trip if and only if John comes and Anil doesn't come
   b) A necessary condition for Anil coming to the school trip, is that, if John and Susan aren't coming, Raj comes

5. Consider a state space where the start state is number 1 and each state k has two successors: numbers 2k and 2k + 1. CO1

   a) Draw the portion of the state space for states 1 to 20. **(1)**
   b) Suppose the goal state is 11. List the order in which nodes will be visited for iterative deepening search. **(1)**

6. Discuss on the drawbacks of Hill climbing. **(2)** CO1

7. Perform alpha-beta pruning method on the following game tree. Find out the alpha, beta and node value at each node. What move should be chosen by the MAX player? **(2)** CO2



National Institute of Technology, Tiruchirappalli - 15
Department of Computer Science and Engineering

Cycle Test 2

CSPC54 – Introduction to Artificial Intelligence and Machine learning

Course/Department : **B.Tech./CSE** Batch : **2021-2025**
Semester/Section : **V A** Session : **July/2023**
Date and Time : **06-11-2023 & 03.00 PM – 04.00 PM** Marks : **15**

Answer ALL Questions with proper steps and justification.
Draw diagrams wherever necessary.

1. Construct decision tree for the prediction of Graduate Admissions from an Indian perspective. The dataset consists of following attributes. Select proper attributes using information gain. Perform decision tree construction up to level 2 considering root of the tree is at level 0. **(4)** CO4

    1. GRE Scores (out of 340), GRE, (>320, <=320)
    2. TOEFL Scores (out of 120), TOEFL, (>108, <=108)
    3. University Rating (out of 5), URating, (5-4, 3, 2-1)
    4. Statement of Purpose and Letter of Recommendation Strength (out of 5), S&L, (5-4, 3.9-3, 2.9-1)
    5. Undergraduate GPA (out of 10), CGPA, (>=9, 8-8.99)
    6. Chance of Admit (0 OR 1)

Sl No.	GRE	TOEFL	URating	S&L	CGPA	Class
1	**337**	**118**	**4**	**4.5**	**9.65**	**1**
2	**322**	**110**	**3**	**3.5**	**8.67**	**1**
3	314	103	2	2	8.21	0
4	**330**	**115**	**5**	**4.5**	**9.34**	**1**
5	321	109	3	3	8.2	0
6	302	102	1	2	8	0
7	325	106	3	3.5	8.4	0
8	**327**	**111**	**4**	**4**	**9**	**1**
9	307	109	3	4	8	0
10	**320**	**110**	**5**	**5**	**9.2**	**1**

2. With the help of a suitable example discuss on exhaustive decomposition in categories. **(1)** CO2

3. Consider the following KB. Check whether Patty likes Rob using backward chaining and unification. **(2)** CO3

    $\forall x\ cat(x) \wedge fish(y) \Rightarrow likes(x, y)$

    $\forall x\ cat(x) \wedge bird(y) \Rightarrow likes(x, y)$

    $\forall x\ flies(x) \wedge feather(x) \Rightarrow bird(x)$

    $cat(Patty),\ fish(Pinto),\ flies(Rob),\ feather(Rob)$

4. Formalize the following sentence in First-order logic. CO3

   a) There exists a lawyer all of whose customers are doctors. **(1)**

   b) No two people have the same Aadhaar number. **(1)**

5. Discuss on Walksat algorithm and its exit scenarios. **(2)** CO3

6. Discuss on Successor-state axiom and its use. Provide an example. **(2)** CO2, 3

7. Given the full joint distribution shown in table, calculate P(*Toothache* | *cavity*) . **(2)** CO4

	toothache		*¬toothache*	
	catch	*¬catch*	*catch*	*¬catch*
cavity	0.108	0.012	0.072	0.008
¬cavity	0.016	0.064	0.144	0.576

National Institute of Technology, Tiruchirappalli – 15
Department of Computer Science and Engineering
End Semester Examination
CSPC54 – Introduction to Artificial Intelligence and Machine learning

Course/Department : **B.Tech./CSE** Batch : **2021-2025**
Semester/Section : **V A** Session : **July/2023**
Date and Time : **07-12-2023 & 10.00 AM – 01.00 PM** Marks : **40**

Answer ALL Questions with proper steps and justification
Draw diagrams wherever necessary.

1. a) "There exist task environments in which no pure reflex agent can behave rationally". Say whether the assertion is true or false and support your answer with examples or counterexamples. **(1)** CO1

   b) You have two jugs, measuring 5 gallons and 3 gallons, and a water faucet. You can fill the jugs up or empty them out (completely) from one to another or onto the ground. You need to end up with exactly 4 gallons in the larger jug. Give a complete problem formation. Write the initial state, goal test, actions, path cost and a potential solution. **(3)** CO2

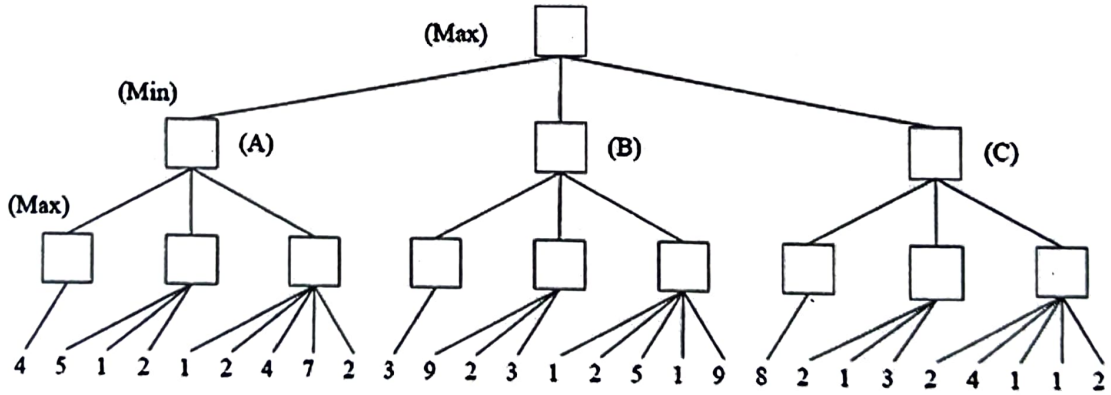
   c) Compare uninformed search strategies such as depth first and iterative deepening in terms of Completeness, Optimality, Time and Space complexity. **(2)** CO1

   d) Write down the pseudo-code for simulated annealing. **(2)** CO1

2. a) Formalize the following sentences using First order Logic. **(1)** CO3
   Every student has taken exactly two elective courses.

   b) Describe how the minimax algorithm change for two-player, nonzero-sum games in which each player has a distinct utility function and both utility functions are known to both players. **(2)** CO2

   c) Perform alpha-beta pruning method on the following game tree. Find out the alpha, beta and node value at each node. What is Max's best move (A, B, or C)? **(3)** CO2



   d) Consider the following sentence: **(2)** CO3
   [(Food ⇒ Party) ∨ (Drinks ⇒ Party)] ⇒ [(Food ∧ Drinks) ⇒ Party]
   Determine, using enumeration (truth table), whether this sentence is valid, satisfiable (but not valid), or unsatisfiable.

3. a) Compare and contrast forward chaining with backward chaining. **(2)** CO3

b) Consider the following KB with rules and facts. Check whether E is entailed by the KB using forward chaining.

KB: R1: $A \wedge B \Rightarrow C$
R2: $C \wedge D \Rightarrow E$
R3: $C \wedge F \Rightarrow G$

F1: A
F2: B
F3: D

(1) CO

c) Draw a semantic network that represents the following data. (2) CO
Tom is a cat. Tom caught a bird. Tom is owned by John. The cat sat on the mat.
A cat is a mammal. A bird is an animal. All mammals are animals.

d) Consider the following facts. (3) CO & 3
All people who are graduating are happy.
All happy people smile.
Someone is graduating.
Conclusion: Is someone smiling?
Represent the facts in first order logic and prove by resolution.

4. a) Explain learning in single-layer feed forward networks. Derive the equations. (3) CO

b) Discuss on the properties that make SVM attractive. (2) CO

c) Consider a binary classification problem – given an image, the classifier is supposed to predict whether the image contains visuals of a cat or not. Assume positive and negative classes and discuss on performance measures such as Precision, Recall and Accuracy on this scenario. (3) CO

5. a) Perform Hierarchical Agglomerative clustering on the following data points: A (7,9), B (20,15), C (14,20), D (23,30), and E (26,10). Use Manhattan distance as the distance function (i.e, Dist (P1, P2) = |x1 - x2| + |y1 - y2|). Merge the clusters using complete linkage and update the proximity matrix accordingly. (3) CO

b) Explain fuzzy clustering in detail. (3) CO & 5

c) Discuss on the applicability of using inertia in finding the optimal number of clusters in k-means clustering. (2) CO

National Institute of Technology Tiruchirappalli

CSPE56-Cloud Computing
July 2023
Department of CSE

Date: 07-09-2023 **Cycle Test-1** **Marks:20**

Answer all the questions.

1. **(a)** Differentiate organizational boundary and trust boundary using suitable examples? [CO1] **2 Marks**

   (b) In a PaaS environment, number of virtual server request is 500000/hour. According to SLA, the price of virtual server is $0.45/hour, and availability is 99%. Calculate the monthly earning of the Cloud environment? [CO2] **2 Marks**

   (c) Give four examples of XaaS platform, also mention its benefits? [CO1] **2 Marks**

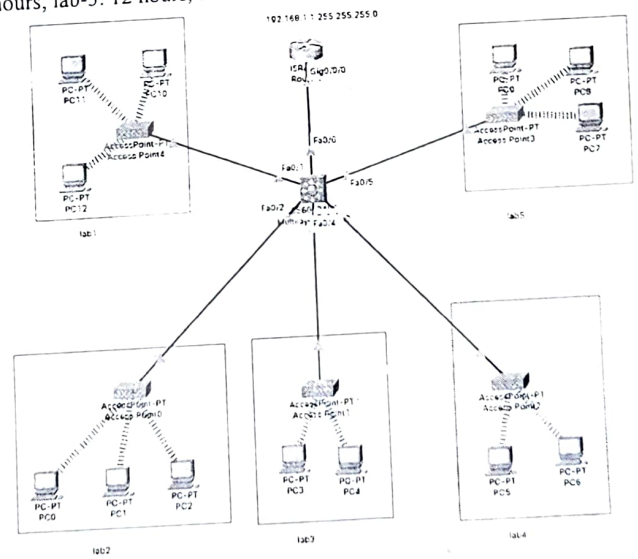
   (d) Explain datagram network functionalities with suitable example and diagram? [CO2] **2 Marks**

   (e) Differentiate NAS and SAN platform. Mention the steps of server virtualization technology? [CO2] **2 Marks**

2. **(a)** Explain NIST cloud computing reference model with description of all the components? [CO1] **5 Marks**

   (b) Calculate the total cost/day the cloud charges for the below shown network considering each constraint? [CO2] **5 Marks**

   Constraints:
   1. No. of virtual machines=5, cost=$0.5/VM/hour, availability=90.05%.
   2. No. of storage available= 3 TB, cost=$1.5/GB/hour
   3. Storage request from lab-1= 300GB, lab-2=500GB, lab-3=2000GB, lab-4 and lab-5=300GB. Priority is: lab-3> lab-2> lab-4 =lab-5>lab-1. Duration of storage and VM request: lab-4 and lab-5: 5 hours, lab-3: 12 hours, lab-2:18 hours, lab-1: 19 hours



National Institute of Technology Tiruchirappalli

CSPE56-Cloud Computing
July 2023
Department of CSE
Cycle Test-2

Date: 02-11-2023 **Marks:20**

Answer all the questions.

1. **(a)** Differentiate VPN and VLAN with suitable example? [CO3] **2 Marks**

   (b) Differentiate active-active and active-passive failover systems with suitable diagrams? [CO3] **2 Marks**

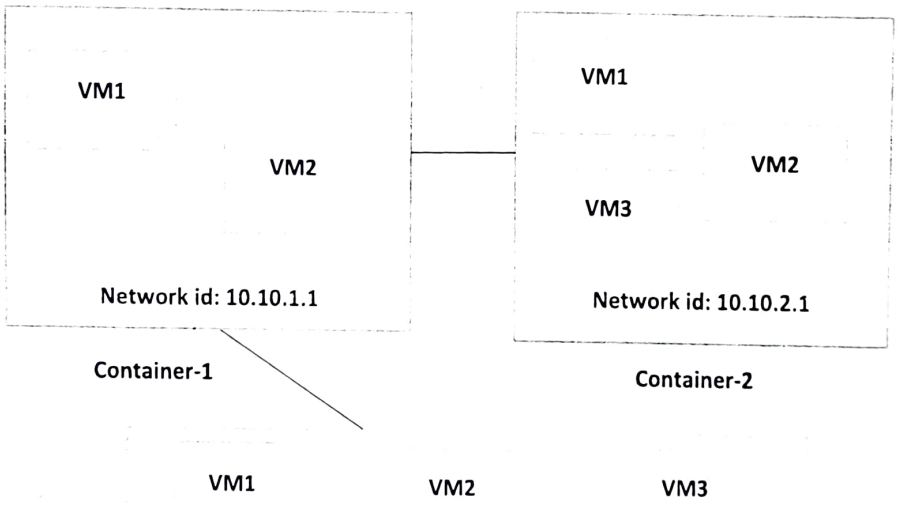
   (c) How many types of CloudStack networking models exist, explain in brief all the models? [CO4] **2 Marks**

   (d) Draw OpenNebula architecture with its components? [CO4] **2 Marks**

   (e) Differentiate public key and private key with a suitable example? [CO3] **2 Marks**

2. **(a)** Explain OpenStack architecture with description of all the components? [CO4] **5 Marks**

   (b) Write the CloudFormation Template for the below network? [CO3] **5 Marks**



National Institute of Technology Tiruchirappalli

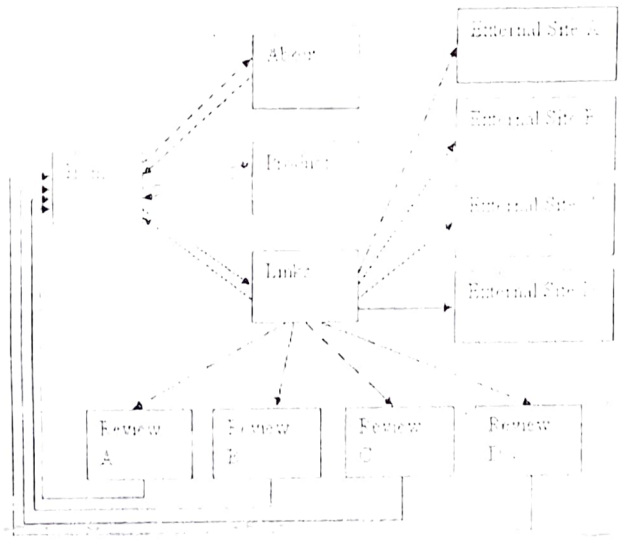
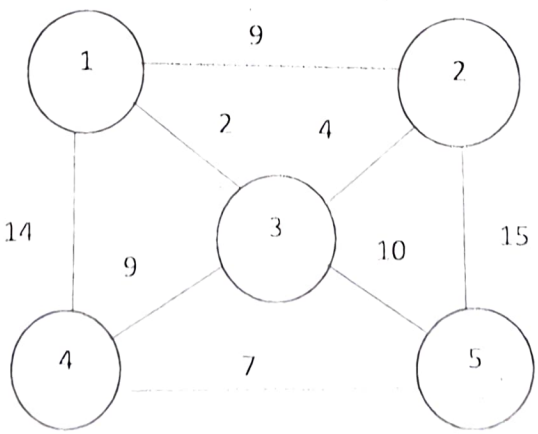
CSPE56-Cloud Computing
July 2023
Department of CSE
End Semester Exam

Date: 08-12-2023

Marks:80

Answer all questions

Question No.	Questions	COs involved	Marks
1.(a)	Draw Edge computing architecture diagram and mention the functions of each tier?	CO5	1
(b)	Compare and contrast Grid and Cloud?	CO2	1
(c)	What is hype cycle of cloud computing?	CO4	1
(d)	Differentiate multitenancy and virtualization?	CO2	1
(e)	Differentiate hypervisor and VIM?	CO3	1
(f)	In a MapReduce framework consider the HDFS block size is 64MB. We have 3 files of size 64Kb, 65Mb, and 127Mb. How many blocks will be created by Hadoop framework?	CO5	1
(g)	Give 4 real-life examples of Cloud Stack?	CO4	1
(h)	Mention 4 use cases of Fog computing?	CO5	1
(i)	What is hashing security mechanism?	CO3	1
(j)	Name the OpenStack deployment models?	CO4	1
2.(a)	Explain Mobile Cloud Computing key components with their workflow?	CO5	2
(b)	Differentiate OS-based and hardware-based virtualization?	CO2	2
(c)	What is RDD and how is it different from Triplet, explain with example?	CO5	2
(d)	Differentiate Open Nebula and Eucalyptus (consider their architecture and application)?	CO4	2
(e)	Differentiate cloud service orchestration and cloud service management?	CO1	2
(f)	Explain cloud usage monitor with its agents?	CO3	2
(g)	Differentiate AWS, GCP, and Azure?	CO4	2
(h)	Differentiate SLA management and billing management system?	CO3	2
(i)	Find the dimension and rank of the following tensor?	CO5	2
(j)	Define REST and its working procedures?	CO2	2
3. (a)	Differentiate IaaS, PaaS, SaaS, and XaaS with suitable examples? What is CloudFormation Template, explain with example?	CO1, CO4	5
(b)	What is service technology? Define its 4 types of services with suitable diagrams and examples?	CO2	5

(c)	Explain resource cluster with diagram and all its types?	CO3	5
(d)	What is parallel computing? Explain the parallel database architecture with diagrams? Give one application of parallel computing architecture?	CO5	5
(e)	Compute total and average salary of organization XYZ and group by gender (male or female) using MapReduce. Write the pseudo code for the same. The input is as follows: <Name, gender, Salary>	CO5	5
(f)	Show all steps with diagram in MapReduce operation to count the number of words present in the following input: `` How many cookies could a good cook cook if a good cook could cook cookies"?	CO5	5
4. (a)	Consider the below graph and find the page rank of each page? Also, mention which page is the popular page and why? 	CO5	10
(b)	Consider the following graph and using GrpahX (write the code in Scala programming) find the shortest path from vertex 4 to all other vertices? 	CO5	10

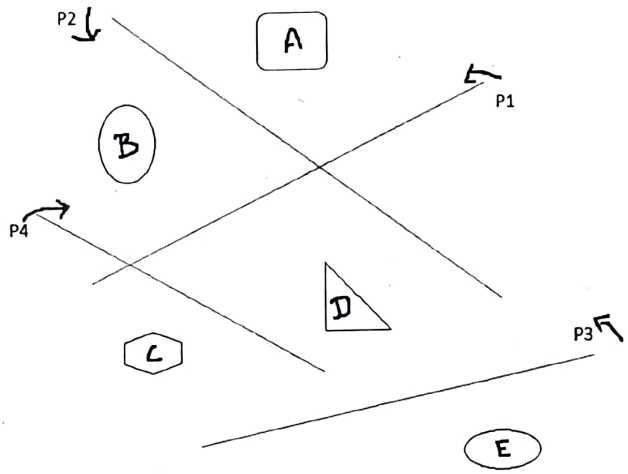
Department of Computer Science & Engineering
National Institute of Technology

CSPE51 – Augmented & Virtual Reality
Cycle Test -2

Date : 03.11.2023 **Time : 11 am – 12 pm** **Max. mark : 20**

1. **a)** Find the vanishing point for the single point perspective projection of a line AB onto the z = 0 plane having the coordinators A [6 4 8 2] and B [6 4 16 2] having a center of projection at $z_c = -2$. (1)
   b) How can you determine the depth of a polygon in a painter's algorithm? (1)
   c) What is a control point? (1)
   d) What is ambient light? (1)

2. **a)** Is the following statement correct?
   "3D rotations about the x-axis followed by an equal angle of rotation about the y-axis is equal to rotation about the y-axis followed by an equal rotation about the x-axis". Justify your answer. (2)
   b) Consider the coordinates of a wooden table have been provided. Write down the transformation steps that would result in drawing the top view of the table on the screen. (2)
   c) Construct a BSP tree for the following (2)



3. **a)** What are the reasons by which the tracker signal may be lost? (1)
   b) What is the need for user-specific calibration in the sensing glove? (1)
   c) How do accuracy and jitter parameters affect the performance of the trackers? Explain it with respect to the different types of trackers. (3)

4. **a)** What are all the design considerations to be followed for developing good haptic feedback interfaces? (2)
   b) What kind of haptic feedback can be obtained in the following devices? Explain how it is obtained.
   i) Joystick, ii) Cyberforce, iii) iFeel (3)

Department of Computer Science & Engineering
National Institute of Technology

CSPE51 – Augmented & Virtual Reality
End Semester Examination

Date : 06.12.2022 **Time : 10.00 am – 01.00 pm** **Max. mark : 40**

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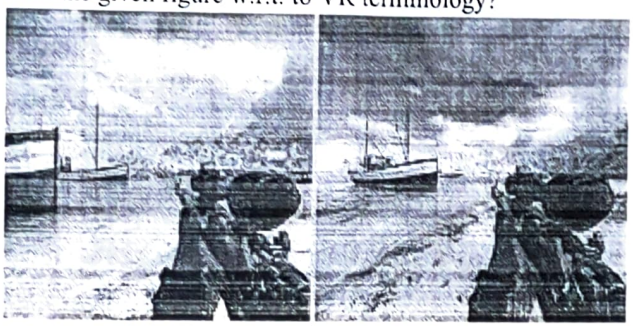
1. a) i) What is inferred from the given figure w.r.t. to VR terminology? (1)



ii) Why 6 DOF is required in VR? (1)

iii) What is Google cardboard? How does it fit into VR world? (2)

b) How is reality compared with the virtual reality? (2)

c) How can a participant interact with the things in the virtual world? Explain in detail. (2)

d) Explain the Field of View and Field of Regard. When can we have FoV = FoR? (2)

2. a) i) Which transformation is helping to achieve a zooming effect on the screen? (1)

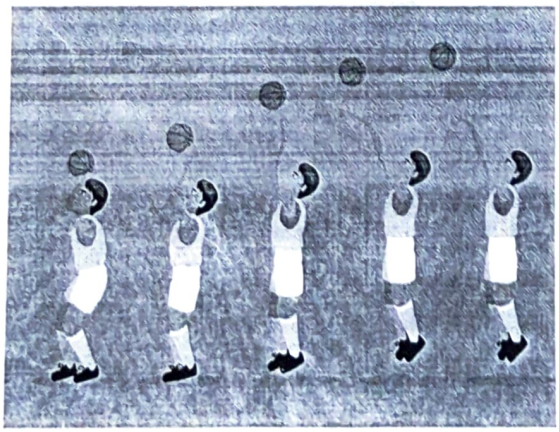
ii) Explain the 3D viewing pipeline. (2)

b) i) A cube has its vertices located at A(0,0,10), B(10,0,10), C(10,10,10), D(0,10,10), E(0,0,0), F(10,0,0), G(10,10,0), H(0,20,0). Note that the y- axis is vertical and positive z- axis is oriented towards the viewer. The cube is being viewed from the point (0,10,50). Draw the perspective view of the cube on the xy plane. (2)

ii) A rectangular parallelopiped having a length on x-axis, y-axis and z-axis as 2, 3, 1 respectively. What is the effect of scaling when scaling factor sx= 1 /2; sy =1/3 and sz = 1? (1)

c) Find the reflected view of a triangle with vertices (3,4), (5,5) and (4,7) about the mirror which is vertically placed such that it passes through (10,0) and (0,10). (2)

d) What kind of transformations are used in the given animation sequence? Explain in detail. (2)



3. a) i) What is temperature feedback? How is it realized? (1)
ii) What is the importance of a hybrid tracker? (1)
iii) Is the 3Ball / 3D mouse provide interaction with the virtual world? Justify your answer. (1)
iv) Why navigation is required in VR? (1)

b) Explain about Tactile feedback interface with an example. (2)

c) What are the parameters that affect the performance of the trackers? Explain how are they used in the trackers (all kinds of trackers). (4)

4. a) In what aspect are the Metaverse and Virtual reality technologies interlinked? Explain it in detail. (2)
b) What are Fiducial markers? How are they used in Augmented reality? (2)
c) Write down the steps involved in the development of AR app. (2)
d) What is projection based AR? Explain different types of Projection based AR. (2)
e) Explain the basic points of view of participants in augmented reality applications. (2)