4. Do not write on the question paper.

Department of Computer Science and Engineering

End Semester Examination

CSPE 51 – Augmented and Virtual Reality

Date : 13.12.2022 **Time : 9.30 am – 12.30 pm** **Max. mark : 40**

---

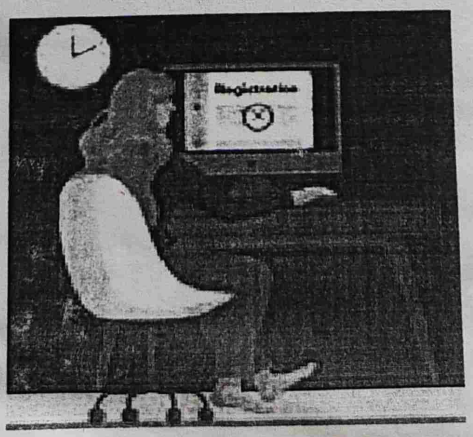
1. a) Why 6 DOF is required in VR? (2)
   b) What is google cardboard? How does it fit into VR world? (2)
   c) List out the travel paradigms used in VR experiences. (4)

2. a) Which transformation is helping to achieve a zooming effect on the screen? (1)
   b) 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) Check whether the 3D rotations about x-axis followed by an equal angle of rotation about y-axis is equal to rotation about the y-axis followed by equal rotation about the x-axis. Justify your answer. (2)
   d) Explain the 2D viewing pipeline. (2)
   e) Obtain a transformation matrix for shearing an object with respect to Y - axis about a specified pivot point (x_f, y_f). (2)

3. a) How is gesture recognition based interaction used in the virtual environment? (2)
   b) What are all the design considerations to be followed for developing good haptic feedback interfaces? (2)
   c) What is the need for a tracker in VR system? Explain different types of trackers in VR with their working, advantages and disadvantages. (4)

4. a) Explain how you can develop a flight Simulator with the help of VR technology. The simulator puts you in the cockpit of a virtual airplane, and you can fly anywhere in the world. Explain in detail about the design steps, implementation details and the components required to develop the simulator. (Use the tool of your choice). (5)
   b) Explain how AR is useful in Google Lens App. (3)

5. a) In what aspect the Metaverse and Virtual reality technologies interlinked? Explain it in detail. (2)
   b) What are Fiducial markers? How are they used in Augmented reality? (3)
   c) Provide the absolute and relative location for each object in the given figure with justification. (3)



4. Do not write on the question paper.
5. Rough works should be done only on the sheet provided at the end of the answer booklet.

Ubiquitous access
Multitenancy

National Institute of Technology Tiruchirappalli

Computer Science and Engineering

B.Tech. V Semester-Section B

End Semester Examination

CSPE56 - Cloud Computing

Date: 14.12.2022 **Time** 9.30AM-12.30PM **Max. Marks: 50**

Answer all the questions

*****

1 a) Write a note on the roles and boundaries of the cloud computing environment. [5M]

b) Discuss any five characteristics of cloud computing with examples. [5M]

2. a) Mention and explain the network subsystems in the Network hardware architecture of Data Center. [5M]

b) Discuss in detail about the REST design constraints. [5M]

3. a) Write about cloud usage monitor in detail. [3M]

b) Describe common types of resource clusters in cloud computing. [3M]

c) Explain in detail about cloud storage devices. [4M]

4. Choose any existing Cloud Provider or Software Platform and explain in terms of the following aspects:
   a) Architecture
   b) Data storage and security
   c) Features
   d) Monitoring and Automation
   e) Advantages and Disadvantages [10M]

5 a) Describe the existing application security schemes in the Mobile Cloud environment with neat diagrams. [5M]

b) Design and justify a working architecture of any real-time application in Mobile Cloud Computing. [5M]

*****All The Best*****

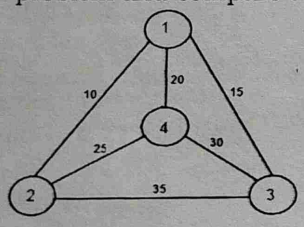
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI – 620015
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.Tech (CSE) – End Semester Examination – July - December 2022
CSPC54– Introduction to Artificial Intelligence and Machine learning

Semester: V, Section: B — Max Marks: 80
Curriculum: NITTUGCSE20 — Time: 3 hours
Date of Exam: 12th December 2022

1. a. Consider the following axioms. Write FOL statements for all of them. Prove the conclusion. (6)
   1. Every child loves every candy. 2. Anyone who loves some candy is not a nutrition fanatic. 3. Anyone who eats any pumpkin is a nutrition fanatic. 4. Anyone who buys any pumpkin either carves it or eats it. 5. John buys a pumpkin. 6. Lifesavers is a candy. 7. (Conclusion) If John is a child, then John carves some pumpkin
   b. Define PEAS for a BABYSITTER to take care of a toddler. What type of agent will you use it for designing the BABYSITTER? Describe diagrammatically the representation of the various actions and percept that the BABYSITTER has to use to take care of the toddler. (6)
   c. Give a complete problem formulation for the following so that it is precise enough to be implemented: (4)
   " A 3-foot-tall monkey is in a room where some bananas are suspended from the 8-foot ceiling. He would like to get the bananas. The room contains two stackable, movable, climbable 3-foot-high crates".

2. a. Explain the A* algorithm and its variants. Using that solve the following TSP problem and compare their performances. (10)



   b. Explain the Expectminimax algorithm. Apply the algorithm to a two player game and explain the calculation of the root node. (6)

3. a. Suppose you are given the following axioms: (6)
   - $0 \leq 6$
   - $10 \leq 15$
   - $\forall x, x \leq x$
   - $\forall x, x \leq x + 0$
   - $\forall x, x + 0 \leq x$
   - $\forall x, y, x + y \leq y + x$
   - $\forall w, x, y, z, \; w \leq y \wedge x \leq z \Rightarrow w + x \leq y + z$
   - $\forall x, y, z, \; x \leq y \wedge y \leq z \Rightarrow x \leq z$

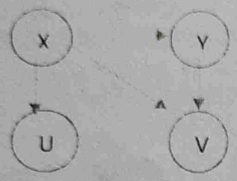
   Use incremental forward chaining proof of the sentence $10 \leq 8 + 15$ by using the axioms. Show all the steps that leads to the success. Verify the same using backward chaining and resolution

b. i. We have a bag of three biased coins a, b, and c with probabilities of coming up heads of 20%, 60% and 80% respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins) and then the coin is flipped three times to generate the outcomes, A, B, C. (5)

i. Draw the Bayesian network corresponding to this set up and draw the necessary conditional probability table.

ii. Calculate which coin was most likely to have been drawn from the bag if the observed flips come out heads twice and tails once.

ii. Consider the following Bayesian belief network. (5)



The probabilities are given as follows:

P(X) = 0.35, P(Y|X) = 0.25, P(Y|~X) = 0.1, P(U|X) = 0.55, P(U|~X) = 0.35, P(V|X,Y) = 0.65, P(V|X,~Y) = 0.25, P(V|~X,Y) = 0.3, P(V|~X, ~Y) = 0.2

Compute the probability of P(X|Y) and P(X, Y, U, V).

4. a. Construct a multi-layer feedforward neural network model that computes the following:
y = A AND B OR ~C
Show the computed weights of the final model. (8)

b. i. How do you handle continuous inputs in Decision Trees? (2)

ii. Construct a decision tree model for the following data and predict the risk class of a car driver based on the following attributes: Time 1- 2 year, Female, Urban. (6)

Time in years	Gender	Area	Risk
1-2	M	Urban	LOW
2-7	M	Rural	HIGH
>7	F	Rural	LOW
1-2	F	Rural	HIGH
>7	M	Rural	HIGH
1-2	M	Rural	HIGH
2-7	F	Urban	LOW
2-7	M	Urban	LOW

5. a. Cluster the following points using complete link clustering and show the clusters. Show the no. of epochs as well. Draw the dendogram. A1= (12,18, 15), A2=(20,15, 21), A3=(16, 14, 21), A4=(19, 8, 12), A5=(17,15, 1), A6=(16, 4, 12), A7=(11, 2, 14), A8=(14, 9, 12). Compare it with single link clustering. (8)

b. For the same dataset, Use Fuzzy C-means clustering to cluster the points and identify the clusters. (8)

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-15

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

V SEMESTER B.TECH, SEMESTER EXAMINATION

CSPC53 COMPUTER NETWORKS

DATE: 09/12/2022 *Answer All Questions* *MAX. MARKS: 50*

1. (a) What are the design issues of OSI model and also discuss the functionalities of network support layers of OSI model. (1+3)

   (b) Double Transposition is used to encrypt the plain text *attack at four* (omit spaces). In the first transposition, the key (3,2,1) is used for permuting the rows. The key for permuting the columns in the second transposition is (4,2,1,3). Find the cipher text and also do the decryption to get back the plain text. (2+2)

2. (a) Illustrate the the different rules that the receiver has to follow while generating an ACK? Each rule must be discussed with the suitable examples. If these rules are not followed, then what will be the consequences? (4+1)

   (b) Error and flow control techniques can be used either in Data link layer or in Transport layer. True or False? Justify your answer. (3)

   (c) Draw the state transition diagram of TCP Reno. (3)

3. (a) Draw the table for classful IP addressing with the following information: Class, NetId, HostID, No. of Blocks, Block size, No. of addresses, Address range for 1st , 2nd and last block address range and Application. (4)

   (b)With the given IP address 73.0.0.0/30, find the network address (with slash notation) for Subnet 4194299. (3)

   (c) An ISP is granted a block of addresses starting with 120.60.4.0/20. The ISP wants to distribute these blocks to 100 organizations with each organization receiving 8 addresses only. Give the address range with slash notation for the following.

   (i) 33rd subnet (ii) 64th subnet (iii) 99th subnet (iv) Find out how many addresses are still available after these allocations. (4)

4. (a) With neat sketch, comment on the following

(i) send window size equals 2^m in Go-back N ARQ
(ii) send window size equals 2^{m-1} in selective Repeat ARQ (4)

(b) Draw the flowchart of CSMA/CA ? Does it guarantee collision free transmission? Justify your answer with suitable examples. (2+2)

(c) Analyze the burst error detection capability of the generator polynomial $x^{14}+x^3+1$. (3)

5. (a) Discuss the role of MTA and MAA elements in the E-mail system with suitable and neat sketches. Also, explain the functionalities of the protocols used in these elements. (3)

(b) Encode the following bit sequence using AMI, B8ZS and HDB3. (3)

1010000100001100001110000111100001010000

(c) Consider the following signal encoding technique. Binary data are presented as input a_m, for m=1,2,3,... Two levels of processing occur. First, a new set of binary numbers are produced: $b_0=0$; $b_m=(a_m+b_{m-1})$ mod 2. These are then encoded as $c_m = b_m - b_{m-1}$. On reception, the original data are recovered by $a_m = c_m$ mod 2. What type of encoding is this? With an example, verify that the received values of a_m equal the transmitted values of a_m. (1+2)

National Institute of Technology, Tiruchirappalli - 15.
Department of Computer Science & Engineering
CSPC52- Database Management Systems
End Semester Examinations- December 2022

Class / Semester : III yr CSE / V sem. **Time : 09:30 to 12.30 P.M**
Venue & Date : Orion S4, S5, S6 & 07/12/2022 **Max. Marks : 50**

Answer all questions

1. (a). A university registrar's office maintains data about the following entities: (5)

- courses, including number, title, credits, syllabus, and prerequisites;
- course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom;
- students, including student-id, name, and program; and
- instructors, including identification number, name, department, and title.

Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled.

(i). Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints.

(ii). Construct appropriate tables for the E-R diagram.

(b). List and explain five significant differences between a file-processing system and a DBMS. (5)

2. (a). Let the following relation schemas be given: (3)

R= (A, B, C) S= (D, E, F)

Let relations r(R)and s(S) be given. Give an expression in SQL that is equivalent to each of the following queries.

(i). $\sigma_{B=17}(r)$

(ii). $\Pi_{A}(r)$

(iii). $r \times s$

(b). Consider the following schema: (2)

Suppliers(sid: integer, sname: string, address: string)

Parts(pid: integer, pname: string, color: string)

Catalog(sid: integer, pid: integer, cost: real)

The key fields are underlined, and the domain of each field is listed after the field name. Write the following queries in relational algebra and SQL.

(i). Find the names of suppliers who supply some red part.

(ii). Find the sids of suppliers who supply some red or green part.

(c). Write an SQL trigger to carry out the following action: On delete of an account, for each owner of the account, check if the owner has any remaining accounts, and if she does not, delete her from the depositor relation. (3)

(d). Consider the following example: create table manager (employee-name char (20), manager-name char (20), primary key employee-name, foreign key (manager-name) references manager on delete cascade). Explain exactly what happens when a tuple in the relation manager is deleted. (2)

3. (a). Consider the relation schema R(ABCDEFGH) with the set of functional dependencies **{AB → C, AC → B, AD → E, B → D, BC → A, E → G}.** Decompose the Relation R till BCNF. (5)

(b). Compute the closure of the following set F of functional dependencies for relation schema R= (A, B, C, D, E). (5)

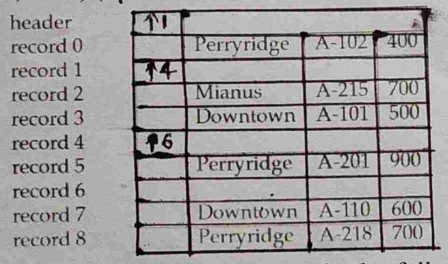
F= {A→BC, CD→E, B→D, E→A}

List the candidate keys for R. Find the Minimal Cover.

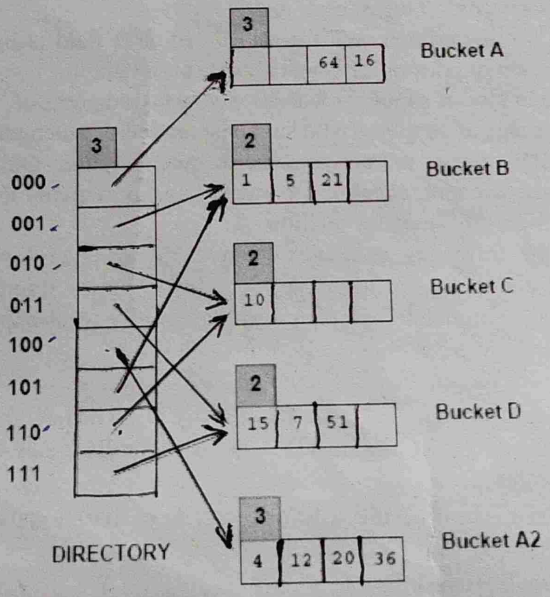
4.(a). Consider the following two transactions: (5)
T1: read(A); read(B); if A=0 then B: =B+1; write(B).
T2: read(B); read(A); if B=0 then A: = A+1; write(A).
Add lock and unlock instructions to transactions T1 and T2, so that they observe the two-phase locking protocol. Can the execution of these transactions result in a deadlock?

(b). Consider the following classes of schedules: conflict-serializable, view-serializable, recoverable. For the following schedule, state which of the preceding classes it belongs to. The actions are listed in the order they are scheduled and prefixed with the transaction name. (5)
T2: R(X), T3: W(X), T3: Commit, T1: W(Y), T1: Commit, T2: R(Y), T2: W(Z), T2: Commit.

5. (a). (i). Explain slotted page structure. (2)
(ii). Show the structure of the file of the following figure after each of the following steps: (3)
a. Insert (Brighton, A-323, 1600)
b. Delete record 2.
c. Insert (Brighton, A-626, 2000) ("i" is used to denote a pointer to record "i").



(b). Consider the Extendible Hashing index shown in the following figure. Answer the following questions about this index: (5)



i. Show the index after inserting an entry with hash value 68.
ii. Show the original index after inserting entries with hash values 17 and 69.
iii. Show the original index after deleting the entry with hash value 21.
iv. Show the original index after deleting the entry with hash value 10.
v. Is a merge triggered by the deletion (iv)? If not, explain why.

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

END SEMESTER EXAMINATION
CSPC51 – Computer Architecture

Branch/Semester/ Section : CSE/ V/ B Time : 09:30AM to 12:30 PM
Date : 06.12.2022 Max Marks : 50

Answer All Questions

1. a. We want to compare the computers R1 and R2, which differ that R1 has the machine instructions for the floating point operations, while R2 has not (FP operations are implemented in the software using several non-FP instructions). Both computers have a clock frequency of 400 MHz. In both we perform the same program, which has the following mixture of commands: (5)

Type the command	Dynamic Share of instructions in program (p_i)	Instruction duration (Number of clock periods CPI_i)	
		R1	R2
FP addition	16%	6	20
FP multiplication	10%	8	32
FP division	8%	10	66
Non - FP instructions	66%	3	3

i) Calculate the MIPS for the computers R1 and R2.
ii) Calculate the CPU program execution time on the computers R1 and R2, if there are 12000 instructions in the program?

b. Assuming that N instructions are executed, and all N instructions are add instructions(takes 4clock cycles), what is the speedup of a pipelined implementation when compared to a multi-cycle implementation? Your answer should be an expression that is a function of N. (Assume clock cycle time is 305 ps) (5)

2. a. In this exercise, we examine how resource hazards, control hazards, and ISA design can affect pipelined execution. Problems in this exercise refer to the following fragment of MIPS code: (5)

	Instruction sequence
a.	lw S1, 40 (S6) beq S2, S0, Label ; Assume S2 == S0 sw S6, 50 (S2) Label: add S2, S3, S4 sw S3, 50 (S4)
b.	lw $5, -16 ($5) sw $4, -16 ($4) lw $3, -20 ($4) beq $2, $0, Label ; Assume $2 != $0 add $5, $1, $4

For this problem, assume that all branches are perfectly predicted (this eliminates all control hazards) and that no delay slots are used. If we only have one memory (for both instructions and data), there is a structural hazard every time we need to fetch an instruction in the same cycle in which another instruction accesses data. To guarantee forward progress, this hazard must always be resolved in favor of the instruction that accesses data. What is the total execution time of this instruction sequence in the five-stage pipeline that only has one memory? We have seen that data hazards can be eliminated by adding nops to the code. Can you do the same with this structural hazard? Why?

b. Problem in this exercise assumes that instructions executed by a pipelined processor are broken down as follows: **(5)**

	ADD	BEQ	LW	SW
a.	50%	25%	15%	10%
b.	30%	15%	35%	20%

i) Assuming there are no stalls and that 60% of all conditional branches are taken, in what percentage of clock cycles does the branch adder in the EX stage generate a value that is actually used?
ii) Assuming there are no stalls, how often (percentage of all cycles) do we use the data memory.

3. How to prevent hazards using Tomasulo's algorithm in Dynamic Scheduling. Explain with an example. **(10)**

4. a. In the following loop, find all the true dependences, output dependences, and antidependences. Eliminate the output dependences and antidependences by renaming. **(5)**

```
for (i=0;i<100;i++) {
        A[i] = A[i] * B[i]; /* S1 */
        B[i] = A[i] + c; /* S2 */
        A[i] = C[i] * c; /* S3 */
        C[i] = D[i] * A[i]; /* S4 */
        }
```

b. Consider the following loop: **(5)**

```
for (i=0;i < 100;i++) {
        A[i] = A[i] + B[i]; /* S1 */
        B[i+1] = C[i] + D[i]; /* S2 */
```

}

Are there dependences between S1 and S2? Is this loop parallel? If not, show how to make it parallel.

5. a. Draw and explain the basic structure of a vector architecture. (3)

b. Explain the two classes of the protocols? A snapshot of the state associated with 2 caches, on 2 separate cores, in a centralized shared memory system is shown below. In this system, cache coherency is maintained with an MSI snooping protocol. You can assume that the caches are direct mapped. (7)

P0	Tag	Data Word 1	Data Word 2	Data Word 3	Data Word 4	Coherency State
Block	1000	10	20	30	40	M
Block 1	4000	500	600	700	800	S
...	...	...	...	...	..	...
Block N	3000	2	4	6	8	S

P1	Tag	Data Word 1	Data Word 2	Data Word 3	Data Word 4	Coherency State
Block	1000	10	10	10	10	I
Block 1	8000	500	600	700	800	S
...	...	...	...	...	..	...
Block N	3000	2	4	6	8	S

i. If P0 wants to write Block 0, what happens to its coherency state?
ii. If P1 writes to Block 1, is Block 1 on P0 invalidated? Why or why not?
iii. If P1 brings in Block M for reading, and no other cache has a copy, what state is it cached in?