

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of Computer Science and Engineering

III-BE CSE – G1 & G2

19Z501 THEORY OF COMPUTING

TUTORIAL TEST 1 Date: 29.07.2024

Time: 8.30 am – 10.10am

Maximum Marks: 25

1. Formulate regular expression for the following statement over $\Sigma = \{0,1\}$ “**Set of binary strings divisible by 2**”. Design and minimize a deterministic finite automaton (DFA) that accepts the same language as this regular expression. In your solution, include the following steps:

[15]

a) Convert the Regular Expression to an Epsilon-NFA:

- o Provide a detailed explanation of the process of converting the given regular expression to an epsilon-NFA (ϵ -NFA).
- o Draw the resulting ϵ -NFA.

b) Convert the Epsilon-NFA to a DFA:

- o Explain the subset construction method to convert the ϵ -NFA to an equivalent DFA.
- o Draw the resulting DFA.

c) Minimize the DFA:

- o Describe the procedure for minimizing a DFA.
- o Draw the minimized DFA.

d) Show the moves for a string of acceptance

e) Analysis:

- o Discuss the differences between DFA and NFA, particularly in terms of state complexity and ease of construction.
- o Explain why minimizing a DFA is important in the context of computational efficiency.

[10]

2. Design DFA for Given Regular Expressions:

- Consider the regular expression for strings beginning with '1': r_1
- Consider the regular expression for strings ending with '1': r_2 .
- Design deterministic finite automata (DFA) for each of these regular expressions.

Analyze Closure Properties:

- Identify and discuss whether the language described by the regular expressions r_1 and r_2 are closed under the following operations.

- Union
- Concatenation
- Reversal
- Kleene Closure (R^*)
- Complement
- Difference
- Intersection

Provide detailed explanations and justifications for each property.

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of Computer Science and Engineering

BE CSE [G1 & G2] & SEM 5

CONTINUOUS ASSESSMENT TEST 1 Date: 8.8.2024

19Z501 – Theory of Computing
Time: 1 Hour 30 minutes.

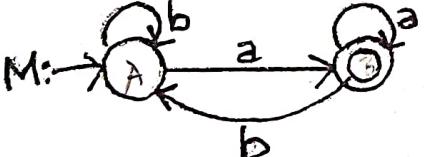
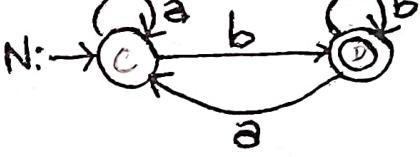
Maximum Marks: 50

INSTRUCTIONS:

1. Answer **ALL** questions. Each Question carries 25 Marks.
2. In each question, subdivision a contains 5 questions and the weightage of each question is one mark, subdivision b(i) and b(ii) carries 5 marks each and subdivision c carries 10 marks each.
3. Subdivisions (a) and (b) will be with no choice and Subdivision (c) may be with choice but not in more than 1 question.
4. Course Outcome Table

Qn. 1 CO1

Qn.2 CO2

1.a	(5x1mark=5marks)	BTL
i) Which of the following languages is generated by the given grammar? $S \rightarrow aS \mid bS \mid \epsilon$ A) $a^n b^m \mid n, m \geq 0$ B) $\{w = \{a, b\}^* \mid w \text{ has equal number of } a's \text{ and } b's\}$ C) $\{a^n \mid n \geq 0\} \cup \{b^n \mid n \geq 0\} \cup \{a^n b^n \mid n \geq 0\}$ D) $\{a+b\}^*$	L1	
ii) Consider the following DFAs.  	L2	
No of states for $L(M) \cap L(N)$ is A) 0 B) 1 C) 2 D) 4		
iii) 3) Consider L1 with productions $S \rightarrow aSb \mid \epsilon$ and L2 with productions $S \rightarrow abS \mid \epsilon$. Say True / False P1: L1 is Regular P2: L2 is Regular A) P1 is True , P2 is True B) P1 is True , P2 is False C) P1 is False, P2 is True D) P1 is False, P2 is False	L2	

iv)	Find E^R for the regular expression $E=01^*+10^*$ _____	L1
v)	If we consider an arbitrary NFA (non-deterministic finite automaton) with N states in total, the maximum number of states that are there in an equivalent DFA (minimized) is at least _____	L1
b.	(2 x 5 marks = 10 marks)	
i)	Consider $\Sigma = \{0\}$. Construct DFA for language L1 (odd length strings) and L2(even length strings). Construct DFA and find the RE for the language L1-L2	L3
ii)	State pumping lemma for regular languages. Use pumping lemma to show that $L = \{a^i b^j \mid i \geq j\}$ is not regular	L3
c.	(1 x 10 marks = 10 marks)	
	Consider $\Sigma = \{0\}$. Form regular expression for odd length strings. Construct ϵ -NFA using Thompson's rules. Convert it to DFA using subset construction procedure. Construct minimised DFA. Show the moves of the automaton for string of acceptance. Write the procedure for subset construction.	L5 (10)

2.a	(5x1mark=5marks)	BTL
i)	Context Free languages are not closed under A) substitution B) reversal C) difference D) homomorphism	L2
ii)	Consider the $G=\{V=\{S,A\}, \Sigma=\{0,1\}, P, S\}$ $S \rightarrow 1S 0A0S \epsilon$ $A \rightarrow 1A \epsilon$ Language accepts A) Palindromes of even length B) Palindromes of odd length C) all binary strings with an even number of 0's D) all binary strings with 11 as substring	L1
iii)	Identify the Language generated by the grammar $S \rightarrow AB$ $A \rightarrow aAb \epsilon$ $B \rightarrow bB b$ A) $\{a^m b^n \mid n \geq m, m > 0\}$ B) $\{a^m b^n \mid n > m, m \geq 0\}$ C) $\{a^m b^n \mid n > m, m > 0\}$ D) $\{a^m b^n \mid n \geq m, m \geq 0\}$	L2

iv)	Given the grammar with the production rules $A \rightarrow Aa \mid b$, rewrite the grammar to eliminate any left recursion.	L2
v)	Write down the regular expression for the set of strings generated by the following CFG $S \rightarrow SaS \mid b$	L1
b.	(2 x 5 marks = 10 marks)	
i)	Analyze the different classes of languages in the Chomsky hierarchy and the corresponding types of automata that recognize these languages. For each class, provide an example of a language and justify its classification within that class.	L5
ii)	Examine the given grammar to determine whether it exhibits ambiguity. $S \rightarrow ABC$ $A \rightarrow aA \mid \epsilon$ $B \rightarrow bC \mid b$ $C \rightarrow c \mid \epsilon$	L3
c.	(1 x 10 marks = 10 marks)	
i)	Evaluate the concepts of Chomsky Normal Form (CNF) and Greibach Normal Form (GNF) in the context of context-free grammars. What are the fundamental differences between these two normal forms, and what roles do they play in formal language theory? Additionally, for the provided context-free grammar G: $S \rightarrow AB \mid a$ $A \rightarrow aA \mid \epsilon$ $B \rightarrow bB \mid \epsilon$ Demonstrate the process of converting it into both CNF and GNF, and explain the significance of these conversions.	L5

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004
Department of Computer Science and Engineering
BE CSE & SEMESTER V
CONTINUOUS ASSESSMENT TEST I Date: 08.08.2024
19Z502 - MICROPROCESSORS AND INTERFACING

Time: 1 Hour 30 minutes.

Maximum Marks: 50

INSTRUCTIONS:

1. Answer **ALL** questions. Each Question carries 25 Marks.
2. In each question, subdivision **a** carries total of 5 marks (one mark for each question), subdivisions **b(i)** and **b(ii)** carries 5 marks each and subdivision **c** carries 10 marks each.
3. Course Outcome Table:

Qn. 1	CO 1
Qn. 2	CO 2

(5 x 1 mark = 5 marks)

1. a

- i. In 8086 microprocessor, for a PUSH instruction after each execution of the instruction, the stack pointer is
 - A) Incremented by 1
 - B) Decrement by 1
 - C) Incremented by 2
 - D) Decremented by 2
 - C) Identify the instructions with correct syntax
 - I MOV DS,1000
 - II NEG BL
 - III CBW BL
 - IV SHR BX, CL

✓A) II and IV only B) II only C) I and II only D) I, II and III only
 - D) The size of each segment in 8086 is
 - A) 64KB
 - B) 24KB
 - C) 128 KB
 - D) 256 KB
 - E) Given a number 9AH (in hexadecimal format). Show how it's represented in Unpacked BCD and packed BCD format. Show the output in binary form. *Convert to decimal and represent*
 - F) The program that follows implements a delay loop.
- MOV CX, 0280H
 DLY: DEC CX *639*
 JNZ DLY
- NXT: ...
- How many times (in decimal) does the JNZ DLY instruction jump to DLY label?

(2 x 5 marks = 10 marks)

b.

- i. Sketch the software architecture of 8086 processor and explain its register organization.
- ii. List the types addressing modes available in 8086. Explain the various memory operand addressing modes of 8086 with appropriate example.

(1 x 10 marks = 10 marks)

- An array of 16-bit numbers is saved in memory location starting from 2000. The size of the array (16-bit number) is stored in location 2500 and 2501. There will be exactly one element repeated in the array. Write an assembly language program to find the repeated element in the array and save it (16-bit number) in location 2502 and 2503.

For Example:

Input:

Memory location	Values (HEX)	Value in Decimal
2000	06	
2001	00	6
2002	00	
2003	00	0
2004	00	
2005	001	257
2006	00	
2007	01	257
Memory location	Values (HEX)	Value in Decimal
2500	06	
2501	00	4

Output:

Memory location	Values (HEX)	Value in Decimal
2502	00	
2503	01	257

(5 x 1 mark = 5 marks)

2. a.

- i. Identify the output signal/s of 8086 from the following
 A) M/IC B) HLDA C) READY D) INTR

ii. Pick the TRUE statement/s from the following.

- I. Switching RESET to logic 0 initializes the internal registers of the MPU.
 II. 'LOCK' is an input signal which is used to lock out processor from using the bus.
 III. NMI is the interrupt request with highest priority and cannot be masked by software.
 A) I only B) II and III only C) I and III only D) I and II only
 iii. What does status code S4S3 = 01 mean in terms of memory segment being accessed by microprocessor?
 A) Extra Segment B) Code Segment C) Data Segment D) Stack Segment

- iv. How many minimum and maximum number of idle states that can be inserted in a 8086 microprocessor? $0 \leftarrow \infty$

- v. What is the duration of the bus cycle in the 8088 microprocessor if the clock is 5 MHz and three wait states are inserted? 1400 ns

(2 x 5 marks = 10 marks)

- b.
 i. Compare 8088 and 8086 microprocessor for maximum and minimum mode of operation.

- 16 bit*
 ii. Demonstrate with a diagram on how a misaligned word is transferred from memory to 8086 processor, using the concept of memory bank. Identify all the signals involved in this process?

(1 x 10 marks = 10 marks)

- c. Consider a byte 45_{16} is written to memory address $0A00D_{16}$ of an 8086 based microcomputer operating in minimum mode. What type of bus cycle does the processor uses for this interaction? Illustrate that with a timing diagram.

$$\frac{1}{5 \times 10^6}$$

$$0.2 \times 10^{-6}$$

200ns x 7

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of Computer Science and Engineering

B.E CSE & 5th Semester

CONTINUOUS ASSESSMENT TEST 2 Date: 09.08.2024

19Z503 - Artificial Intelligence

Maximum Marks: 50

Time: 1 Hour 30 minutes.

INSTRUCTIONS:

1. Answer **ALL** questions. Each Question carries 25 Marks.
2. In each question, subdivision **a** contains 5 questions and the weightage of each question is one mark, subdivision **b(i)** and **b(ii)** carries 5 marks each and subdivision **c** carries 10 marks each.
3. Subdivisions (a) and (b) will be with no choice and Subdivision (c) may be with choice but not in more than 1 question.
4. Course Outcome Table :

Qn. 1	CO1	Qn. 2	CO2
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(5 x 1 mark = 5 marks)

1. a

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

i. Which of the following is NOT a characteristic of a Simplex Agent? L2

- A) Considers only current percept
- B) Used where condition-action rule is present
- C) Limited intelligence
- D) Internal state to track the percept sequence

ii. In the context of intelligent agents, what does 'autonomy' refer to? L1

- A) The ability to perform tasks without human intervention
- B) The speed at which an agent makes decisions
- C) The accuracy of the sensors
- D) The number of goals an agent can achieve

iii. Which of the following is a recoverable problem? L2

- A) Water Jug problem
- B) Moving tiles problem
- C) Chess
- D) Proving theorems

Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

iv. In a Learning agent model, _____ is responsible for selecting external actions L1

Performance element

v. _____ environment allows for complete knowledge of past, current, and future states L2

Fully observable

(2 x 5 marks = 10 marks)

- b.
- Compare and contrast goal-based agents and utility-based agents. In what scenarios would each be more appropriate? L3

- Explain the PEAS framework and its components in detail. How does each component contribute to the overall functioning of an intelligent agent? Explain with an example L3

(1 x 10 marks = 10 marks) L5

- c.
- Draw the architecture of a typical learning agent. What are its key components and their functions? Consider a smart home system. Examine the role of learning agents in smart home systems (thermostats, lighting etc). How do these agents learn user preferences and adapt to lifestyle changes?

(OR)

The Missionaries and Cannibals problem is a classic puzzle that involves getting three missionaries and three cannibals across a river using a boat that can carry at most two people at a time, without ever leaving more cannibals than missionaries on either side of the river (to avoid the cannibals eating the missionaries). Depict a suitable state representation with its problem characteristics

2. a (5 x 1 mark = 5 marks)

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

- In which search strategy is the next node to be expanded chosen based on the lowest path cost from the start node? L2

A) Uniform Cost Search
C) Breadth first search

B) Depth First search
D) Iterative Deepening search

- If a heuristic is consistent (monotonic), what property does it possess? L1

- A) The estimated cost to reach the goal is always the same.
- B) The estimated cost is always less than or equal to the actual cost from the current node to the goal.
- C) The estimated cost is always less than or equal to the cost of getting from the current node to any neighbor plus the estimated cost from that neighbor to the goal.
- D) It always leads to the shortest path.

- Which of the following search algorithm is optimal if the heuristic function used is admissible and the search space is a tree? L2

- i) A* search
 ii) Greedy best first search

A) Both are true
 C) (i) is true and (ii) is false

B) Both are false
 D) (ii) is true and (i) is false

Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

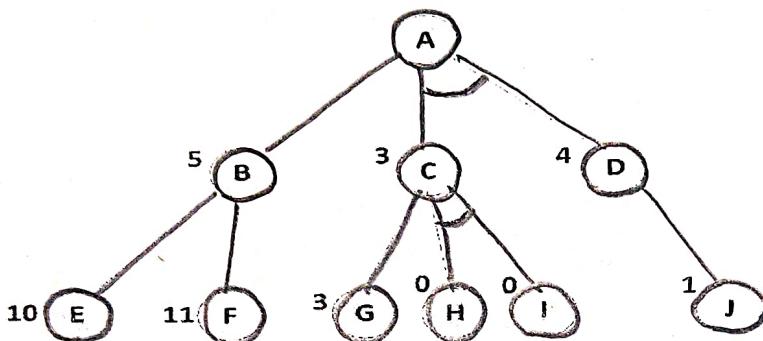
iv. Informed search is _____ L1

v. _____ is a heuristic for 8-puzzle problem L2

b.

number of puzzle misplaced from goal state (2 x 5 marks = 10 marks)

i. Illustrate how AO* algorithm can be applied for problem decomposition. Trace the algorithm with the following graph. L3



ii. Given a maze represented as a grid, where walls and free spaces are indicated, and a start and end point are specified, you have to find a path from the start to the end. The depth of the solution is unknown and space efficiency is a concern. Analyse what would be the optimal search strategy with suitable inference? L4

c.

(1 x 10 marks = 10 marks) L5

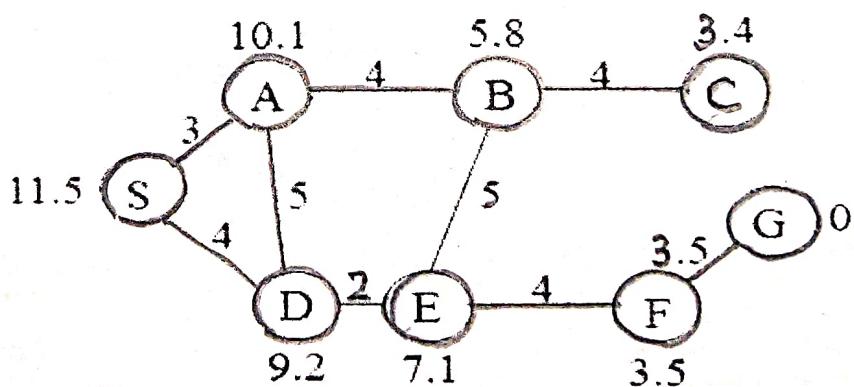


Figure - 1

For the above graph figure 1, apply A* algorithm and find the optimal path from S to G. Assuming the above graph uses straight line distance heuristic, test the optimality using A* search algorithm

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of CSE

BE CSE & SEM 5

CONTINUOUS ASSESSMENT TEST 1 Date: 09.08.2024

19Z504 – COMPUTER NETWORKS

Time: 1 Hour 30 minutes.

Maximum Marks: 50

INSTRUCTIONS:

- Answer **ALL** questions. Each Question carries 25 Marks.
- In each question, subdivision a carries total of 5 marks (one mark for each question), subdivisions b(i) and b(ii) carries 5 marks each and subdivision c carries 10 marks each.

3. Course Outcome Table :

Qn. 1	CO1
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Qn.2	CO2
------	-----

1.a	(5 x 1 mark = 5 marks)	BTL
i)	Match the following (i) Physical Layer (a) hop to hop communication (ii) Transport Layer (b) digital data into digital signal (iii) Network Layer (c) node to node communication (iv) Data link layer (d) Process to process communication A) (i) - (a), (ii) - (c), (iii) - (b), iv - (d) <input checked="" type="checkbox"/> (i) - (b), (ii) - (d), (iii) - (c), (iv) - (a) C) (i) - (d), (ii) - (b), (iii) - (a), iv - (c) D) (i) - (d), (ii) - (c), (iii) - (a), iv - (b)	L2
ii)	Which of the following is a broadcast device? <input checked="" type="checkbox"/> Hub B) Switch C) Router D) Repeater	L1
iii)	_____ is the networking device that takes data sent from one LAN device and forwards it to the destination device based on MAC address. (in a homogeneous network) A) Router <input checked="" type="checkbox"/> B) Switch C) Hub D) Gateway	L3
iv)	In _____ networks the resources needed for communication between the end-systems are reserved for the duration of the session.	L3
v)	If there are 10 nodes connected using Mesh topology (fully connected) then the number of links are <u>45</u> . <i>n(n-1)</i>	L3
1. b	(2 x 5 marks = 10 marks)	
i)	Consider a source computer(S) transmitting a file of size 10^6 bits to a destination computer (D) over a network of two routers (R1 and R2) and three links (L1, L2, and L3). L1 connects S to R1; L2 connects R1 to R2; and L3 connects R2 to D. Let each link be of length 200 km. Assume signals travel over each link at a speed of 10^8 m/s. Assume that the link bandwidth on each link is 1Mbps. Let the file be broken down into 1000 packets each of size 1000 bits. Find the total sum of transmission and propagation delays in transmitting the file from S to D?	L5
ii)	Draw the architecture of OSI reference model and brief about its features.	L2
1.c	(1 x 10 marks = 10 marks)	
i)	Suppose a 128-kbps point-to-point link is set up between the Earth and a rover	L5

Circuit - switched

on Mars. The distance from the Earth to Mars (when they are closest together) is approximately 55 Gm, and data travels over the link at the speed of light is 3×10^8 m/s.

- (a) Calculate the minimum RTT for the link.
- (b) Calculate the delay \times bandwidth product for the link.
- (c) Provide an interpretation of the bandwidth-delay product.

(d) A camera on the rover takes pictures of its surroundings and sends these to Earth. How quickly after a picture is taken can it reach Mission Control on Earth? Assume that each image is 2MB in size.

2.a (5 x 1 mark = 5 marks)

- | | | |
|------|---|----|
| i) | The data link layer takes the packets from _____ layer and encapsulates them into frames for transmission.
A) Physical Layer B) Application Layer C) Network Layer D) Transport Layer | L1 |
| ii) | Which of the following functionality is not performed by the data link layer?
A) Framing B) Error control C) Flow control D) channel coding | L1 |
| iii) | Header of a frame generally contains _____
A) Payload B) Addresses C) Error control data D) signal | L1 |
| iv) | In bit stuffing, each frame begins and end with a bit pattern in hexadecimal is
<u>7E</u> | L3 |
| v) | The total span of a 10 Base5 Ethernet is (including repeaters) _____ meters
<u>2500</u> | L1 |

2. b (2 x 5 marks = 10 marks)

- | | | |
|-----|--|----|
| i) | Given the data word 110110101 and the divisor 1101. Show the generation of the codeword at the sender site and verify the same at the receiver site. | L4 |
| ii) | Explain the need for the exponential back off algorithm in Ethernet. | L2 |

2.c (1 x 10 marks = 10 marks)

- | | | |
|----|--|----|
| i) | Suppose that a sender is using ARQ to perform reliable data delivery. Draw the sliding window flow diagram for the following:
1. How many sequence numbers are required to implement stop and wait?
2. In a Go-Back N ARQ protocol, the window size is 6. Frames with sequence numbers 1, 2, 3, 4 and 5 have been sent. The sender just received an ACK for frame 1. Frames 6, 7, 8, 9 & 10 are waiting to be sent. Draw the time diagram along with Positions of S_n, R_n .
3. Some time later, the sender transmitted frames 20, 21, 22, 23, 24, and 25; however, frame 22 got lost. If Go-Back-N is used, what frame(s) would the sender have to retransmit? | L6 |
|----|--|----|

OR

- | | | |
|-----|---|----|
| ii) | Suppose you are designing a sliding window protocol for a 1-Mbps point to point link to the stationary satellite revolving around the earth at an altitude of 3×10^4 km. Assuming that each frame carries 1 KB of data, what is the minimum number of bits you need for the sequence number in the following cases? Hint: Use RTT (two way latency as the delay)
(a) RWS=1 (b) RWS=SWS | L6 |
|-----|---|----|

PSG COLLEGE OF TECHNOLOGY, Department of CSE
BE CSE Semester 5, 19Z505 – Object-Oriented Analysis and Design
ASSESSMENT TUTORIAL TEST1 Date: 29/07/2024
Time: 100 minutes **Max. Marks: 20**

1 Problem Description

In a hall management system like that of IIT KGP, students are accommodated in 20 Halls of Residence which are managed by HMC(Hall Maintenance Centre). These halls are administered by Wardens and Assistant Wardens (Mess, Maintenance, Allotment) with help of hall managers and supervisors.

Catering service is provided by the regular hall staff members in some of the halls, and for the remaining halls it has been outsourced to private agencies. Cleaning service is outsourced for all the halls of residence. Activities related to Mess operations and monitoring, sports and games, cultural events, library etc. are managed by various elected general secretaries and overseen by The Hall President.

secretaries and overseen by The Hall President. You are required to design an equivalent Hall Management System (HMS). Some of the use cases are given in the next section. Your system should not be limited to the given use cases. Add more attractive features.

2 Use Cases for the HMS

2.1 Initial Hall Allocation

- 2.1 Initial Hall Allocation:**

 - The student pays the admission fees via ERP (Enterprise Resource Planning).
 - ERP profile is generated and hall is allocated based on the student's category (BTech, MTech, MS or Phd).
 - On the day of admission, the student submits the required documents at the hall and is allocated a room (single or sharing).

2.2 Change Hall

- HMC advertises for filling up vacant rooms in various halls.
 - Student submits application.
 - New hall is allocated based on seniority.

Variation: Mutual Change (Swapping) of Halls

- HMC advertises for mutual change (swapping) of halls.
 - Two consenting bachelor students A and B fill up a common form.
 - If student A from hall X is allowed to swap with student B from hall Y, then A will move to hall Y and occupy the same room allotted where B was staying and B will be allotted the room where A was staying. In hall X, the mess bill and other dues of student A will be charged on student B and in hall Y, the mess bill and other dues of student B will be charged on student A.

2.3 Submit a Complaint Related to Maintenance

- Student submits a complaint letter to hall manager/supervisor.
- If it is an addressable complaint, the hall manager/supervisor forwards it to Assistant Warden (maintenance).
- Assistant Warden (maintenance) addresses the problem with the help of HMC.

2.4 Submit a Complaint Related to Mess

- Student submits a complaint letter to General Secretary (Mess)/ writes in the complaint register.
- If it is an addressable complaint, General Secretary (Mess) forwards it to Assistant Warden (Mess).
- Assistant Warden (Mess) addresses the problem with the help of HMC.

2.5 Booking Guest Room in Hall

- Student submits an application to hall manager mentioning the duration and dates.
- If guest room is available for the requested time period, the hall manager approves the request.

3 Some Other Operations of the HMS

- Maintenance of student record.
- Maintenance of HMC employee record.
- Generating alert messages (or emails) for due fee payment.
- Display of general information of a hall.
- Query regarding vacancy in a hall.
- Query regarding staff recruitment (catering/cleaning) in a hall

Question

1. Find the actors, possible use cases and draw the use case diagram (5 marks)
2. Write use case specification for the three most important use cases (15 marks)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004
Department of CSE

BE CSE Semester 5

CONTINUOUS ASSESSMENT TEST 1 Date: 10/08/2024
 19Z505 -Object-oriented Analysis and Design

Time: 1 Hour 30 minutes.

Maximum Marks: 50

INSTRUCTIONS:

1. Answer **ALL** questions. Each Question carries 25 Marks.
2. In each question, subdivision **a** contains 5 questions and the weightage of each question is one mark, subdivision **b(i)** and **b(ii)** carries 5 marks each and subdivision **c** carries 10 marks each.
3. Subdivisions **(a)** and **(b)** will be with no choice and Subdivision **(c)** may be with choice but not in more than 1 question.
4. Course Outcome Table :

Qn. 1	CO1
-------	-----

Qn.2	CO2
------	-----

1. a

(5 x 1 mark = 5 marks)

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

i. Name the element of a complex system that has the property by which an object continues to exist even after its creator ceases to exist.

- A) Abstraction B) Concurrency C) Typing D) Persistence L1

ii. The inventory management system needs to provide analytical reports. Which element of the object model can be utilized to represent various report types that share common attributes and methods?

- A) Abstraction B) Encapsulation C) Inheritance D) Modularity L2

iii. The Unified Software Development Process is primarily driven by which of the following?

- A) Code generation B) Documentation C) Use cases D) Database design L1

Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

iv. OOA is concerned with developing a object model that capture the requirement. L1
 v. is the least useful among the different types of abstractions in the object model.

coincidental abstraction L1

b.

(2 x 5 marks = 10 marks)

i. Consider a college as a complex system. Discover the existence of five attributes of a complex system in the college. Identify one class structure and one object structure from it. L4

ii. Show the presence of the major elements, abstraction and encapsulation from the following problem statement. Consider the case of a mobile phone. It is provided with an interface for Phone call with facilities for establishing a call, saving a number, selection of a contact. A roaming facility can also be established. Charges for roaming facility are different from that of a normal call. It also has a functionality of camera with facility to take a picture/video, flash etc. Camera facilities can be accessed through an interface. L6

1.b.i. Hi electric : dept, coe, placements, hostels S.E.F - Single pgm & few depts --> many pgms & many dept
 RP - depts, programs, exams, etc
 SOC - dept need not heavily depend on placements
 CP - CA & SEM patterns common across dept
 Class: tutor is a teaching faculty
 Object: dep't as parts of college

(1 x 10 marks = 10 marks)

- c. Analyze the Unified Software Development Process using a "Library management system" software to explain its phases. L4

(5 x 1 mark = 5 marks)

2. a Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number. L1

i. UML is an open standard maintained by

- A) Object Management Group
B) Object Maintenance Group
C) Object Oriented Group
D) Object Design Group

ii. _____ relationship can exist between two actors

- A) Association
B) Generalization
C) Include
D) Composition

iii. Which one of the following cannot be a base use case in a library management system? L1

- A) Borrow a book
B) Return a book
C) Cancel membership
D) Pay late fee penalty

Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

iv. If we consider Car as a system, its brake system can be one of its different Vilus L1

v. _____ use case is present in every software system with different kinds of users. L1

Login

(2 x 5 marks = 10 marks)

b. i. Identify an app from your smartphone, and draw a partial use case diagram which illustrates use cases showing include and generalization relationships with necessary explanation. L3

ii. Develop a short problem statement covering the most important functions of the WhatsApp messaging application. Identify an extend relationship between any two use cases you derive from the statement. Draw a simple use case diagram with the use cases involved in the extend relationship. L6

c. (1 x 10 marks = 10 marks)

A Car Rental System is a software built to handle the renting of automobiles for a short period of time, generally ranging from a few hours to a few weeks. A car rental system often has numerous local branches (to allow its user to return a vehicle to a different location), and primarily located near airports or busy city areas.

The requirements for the System are given below. Identify the actors, and two use cases for each actor. Create a use case diagram for the identified use cases. Write a use case specification for the most important use case.

- The system will support the renting of different automobiles like cars, trucks, SUVs, vans, and motorcycles.
- Each vehicle should be added with a unique barcode and other details, including a parking stall number which helps to locate the vehicle.

- The system should be able to retrieve information like which member took a particular vehicle or what vehicles have been rented out by a specific member.
- The system should collect a late-fee for vehicles returned after the due date.
- Members should be able to search the vehicle inventory and reserve any available vehicle.
- The system should be able to send notifications whenever the reservation is approaching the pick-up date, as well as when the vehicle is nearing the due date or has not been returned within the due date.
- The system will be able to read barcodes from vehicles.
- Members should be able to cancel their reservations.
- The system should maintain a vehicle log to track all events related to the vehicles.
- Members can add rental insurance to their reservation.
- Members can rent additional equipment, like navigation, child seat, ski rack, etc.
- Members can add additional services to their reservation, such as roadside assistance, L6 additional driver, Wi-Fi, etc.

1.b.ii. A : Phone, Phone call, contact, camera

E ÷ Mobile Phone: activate warning

Phone call : saving a no., establish a call, select contact

camera : capture picture / video, turn on/off flash
contact : save contact

1.c. Inception - use cases are decided

Elaboration - use cases finalized, and others

construction - remaining use cases are discovered

transition - System is installed

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of Computer Science and Engineering

BE-CSE

CONTINUOUS ASSESSMENT TEST 1 Date: 10.08.2024

19Z002 - Advanced Data Structures

Time: 1 Hour 30 minutes.

Maximum Marks: 50

INSTRUCTIONS:

1. Answer **ALL** questions. Each Question carries 25 Marks.
2. In each question, subdivision a contains 5 questions and the weightage of each question is one mark, subdivision b(i) and b(ii) carries 5 marks each and subdivision c carries 10 marks each.
3. Subdivisions (a) and (b) will be with no choice and Subdivision (c) may be with choice but not in more than 1 question.
4. _____ Data book / _____ table(s) may be permitted.

5. Course Outcome Table :

Qn. 1	CO1	Qn. 2	CO2
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(5 x 1 mark = 5 marks)

1. a

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

i. Which of the following method use credit as the potential energy to pay for future operations?

- (A) Aggregate method
(C) Potential method

~~(B) Accounting method~~
(D) both (A) and (B)

[L1]

ii. Using the linked-list representation of disjoint sets and the weighted-union heuristic, a sequence of m MAKE-SET, UNION, and FIND-SET operations, n of which are MAKE-SET operations, takes time _____

- ~~(A)~~ O(m + n lg n) B) O(m + lg n) C) O(n + m lg n) D) O((m + n) lg n)

[L2]

iii. Consider an universe size of u and number of elements currently stored in the structure as n, What is the time complexity for finding the minimum element in Proto -Van Emde Boas data structure ?

[L2]

- A) O(lg lg u)

- B) O(lg lg n)

- C) ~~O(lg u)~~

- D) ~~O(lg u lg lg u)~~

Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

iv. In Aggregate method the amortized cost is same for all operation, even when there are several types of operations in the sequence.

[L1]

v. In a recursive structure, where the universe size shrink by the square root of itself at each level of recursion, cluster number($\text{low}(x)$) of given value x is given by _____

[L1]

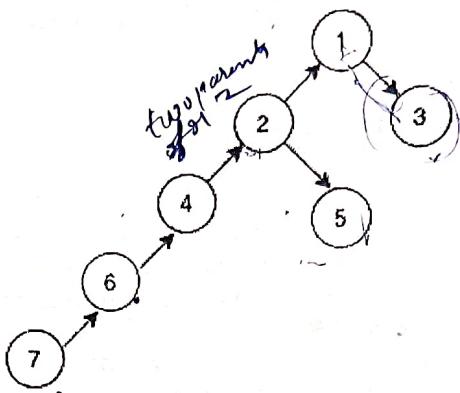
\sqrt{x}

(2 x 5 marks = 10 marks)

b.

- i. Write an algorithm for incrementing a K - bit binary counter to count upward from 0. Examine the complexity of incrementing a binary counter using asymptotic analysis and aggregate method of amortized analysis. [L4]

- ii. Develop an algorithm for path compression. Employ this algorithm to locate the parent of node 7 in the following rooted tree and present the resulting tree. [L5]



(1 x 10 marks = 10 marks)

- c. Construct a vEB(16)-structure with the following elements: 1, 3, 5, 7, 9, 10, 11, 12, 13. Trace the insertion algorithm for inserting the element 15 into the constructed vEB structure. Analyse the complexity of insertion operation. [L5]

2. a

(5 x 1 mark = 5 marks)

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

- i. Which of the following is not a property of leftist heap? [L1]

- A) Key(i) \geq Key(parent(i))
B) The sum of the number of edges on the shortest route from a node to the final leaf of the right child is less than or equal to that of the left child
C) The time complexity of Insert Min is $O(\log n)$
D) It is a complete binary tree

- ii. The worst case time complexity for finding the maximum element, insertion of n elements and deletion of an element in a min heap are _____ [L2]

- A) $O(1)$, $O(n \log n)$, $O(\log n)$ B) $O(\log n)$, $O(n \log n)$, $O(\log n)$
C) $O(n)$, $O(n \log n)$, $O(\log n)$ D) $O(n \log n)$, $O(\log n)$, $O(\log n)$

- iii. The time complexity of finding minimum and maximum element in Min-Max Heap is [L2]

- A) $O(1), O(1)$ B) $O(1), O(\log n)$ C) $O(\log n), O(1)$ D) $O(\log n), O(\log n)$

Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

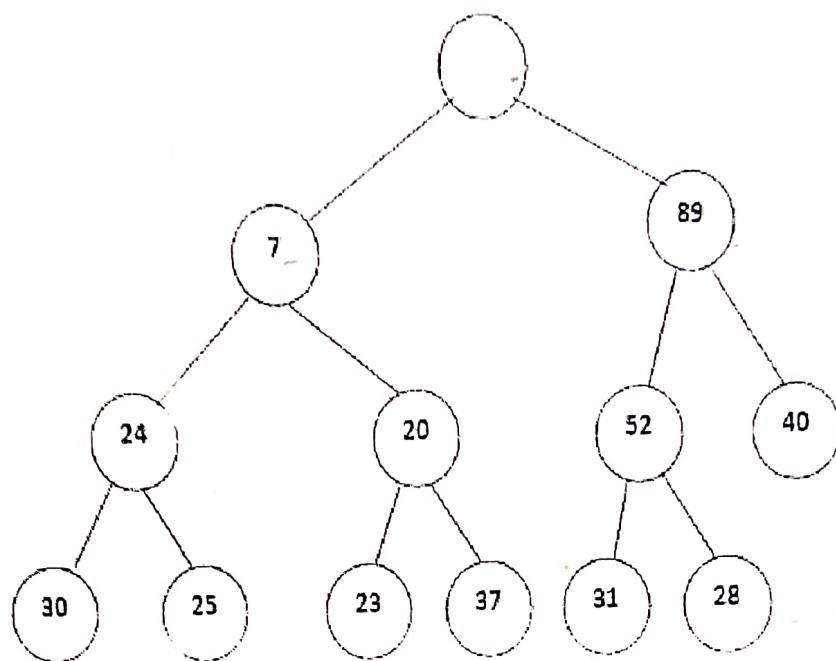
- iv. Consider an element with index i in the min heap of a deap, the corresponding element in the max heap, denoted as corr(i) is found at ___ position. $i + 2^{\lfloor \log_2 i \rfloor} - 1$ [L1]

- v. The maximum number of trees in a binomial heap with N nodes is $L \log_2 N + 1$ [L2]

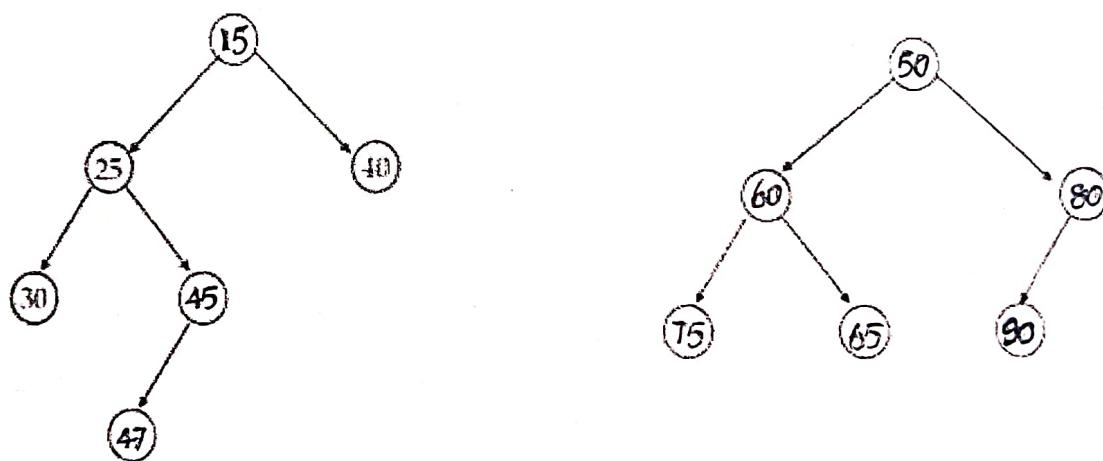
b.

(2 x 5 marks = 10 marks)

- i. Derive an algorithm to insert an element into a deap structure. Trace the algorithm for insert 6 in to the following deap structure. [L5]



- ii. Write an algorithm to merge two leftist heap. Trace the algorithm for merging the leftist heaps given below. [L5]



c.

(1 x 10 marks = 10 marks)

- In an initially empty min-Max heap insert the following keys in the given order: 4, 5, 2, 1, 3, 7, 9, 10, 13, 12, 14 and 15. From the constructed min-Max heap, perform delete-min followed by delete-Max. Analyse the complexity of the operations performed. [L5]