

**Sixth Semester B. E. (Computer Science and Engineering)
Examination**

ARTIFICIAL INTELLIGENCE

Time : 2 Hours]

[Max. Marks : 40

Instructions to Candidates :—

- (1) All questions are compulsory.
- (2) All questions carry marks as indicated.
- (3) Explain your answer with neat sketches, wherever applicable.

1. Consider the 3-water jug problem, which is stated as follows :

There are three jugs of capacity 12, 8 and 5 liters. There is no mark on any jug. Initially the 12-liter jug is filled with water and other two jugs are empty. You cannot get water from any external source and you cannot pour water on the ground.

Determine state representation of 3-water-jug problem.

Determine operators (rules) for 3-water-jug problem.

Apply BFS (graph version) on 3-water jug problem up to 10 iterations Clearly show current node, frontier and explored lists at each iteration. 7(CO1)

2. (a) Explain with examples, various problems due to which hill climbing may get stuck. 3(CO1)

(b) Determine heuristic function for 8-Queen problem. Apply A*(tree version) on 8-Queen problem for 4-iterations with empty chessboard as initial state. Show current node, frontier and explored (if needed) lists at each iteration. 4(CO1)

3. This problem exercises the basic concepts of game playing, using tic-tac-toe (noughts and crosses) as an example. We define X_n as the number of rows, columns, or diagonals with exactly n X's and no O's. Similarly, One is the number of rows, columns, or diagonals with just n O's. The utility function assigns +1 to any position with $X_3 = 1$ and -1 to any position with $O_3 = 1$. All other terminal positions have utility 0. For nonterminal positions, we use a linear evaluation function defined as
 $\text{Eval}(s) = 3X_2(s) + X_1(s) - (3O_2(s) + O_1(s))$.

(a) Approximately how many possible games of tic-tac-toe are there ?

- (b) Show the whole game tree starting from an empty board down to depth 2 (i. e., one X and one O on the board), taking symmetry into account.
- (c) Mark on your tree the evaluations of all the positions at depth 2.
- (d) Using the minmax algorithm, mark on your tree the backed-up values for the positions at depths 1 and 0, and use those values to choose the best starting move.
- (e) Circle the nodes at depth 2 that would not be evaluated if alpha-beta pruning were applied, assuming the nodes are generated in the optimal order for alpha-beta pruning.

7(CO2)

4. (1) It is a crime for an American to sell weapons to hostile nations.

(2) Nono has some missiles.

(3) All of its missiles were sold to it by Colonel West.

(4) All missiles are weapons.

(5) Enemy of America counts as hostile.

(6) Colonel West is American.

(7) Nono, an enemy of America.

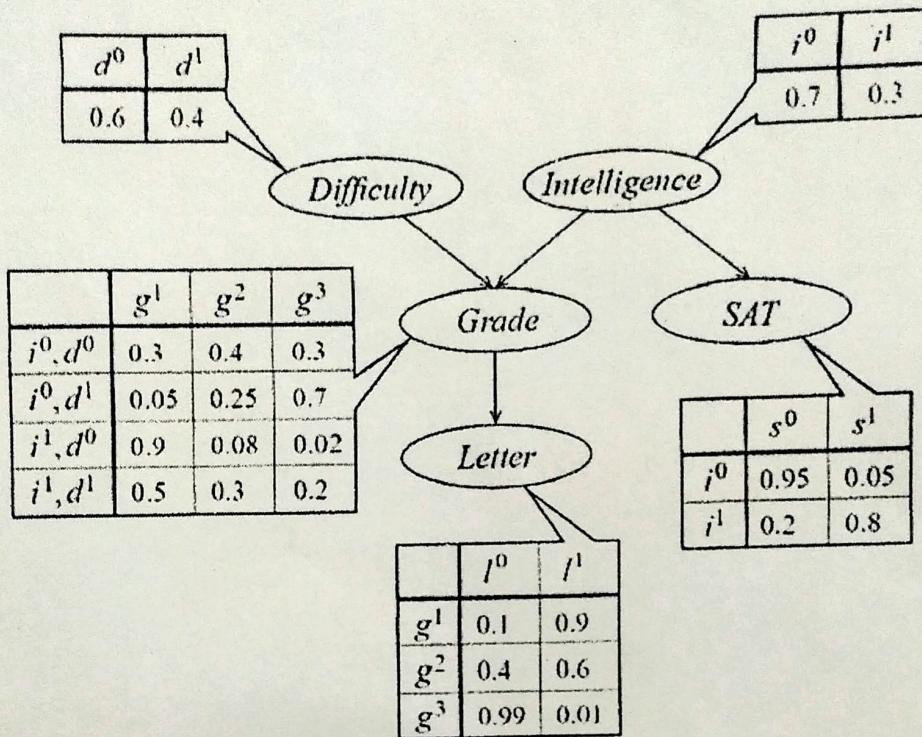
7(CO3)

1. Solve the following :

- (a) Represent these facts using predicate logic.
- (b) Convert all these facts into Prenex normal form.
- (c) Convert all these facts into skolem normal form.

- (d) Answer the question "Is Colonel West Criminal ?"

5.



What is the probability that a student will get a good recommendation letter (l^1), if student is intelligent (i^1) ? 5(CO4)

6. (a) Construct decision trees to represent the following Boolean functions :
- A OR [B AND C]
 - [A AND B] OR [C AND D]
- 3(CO5)
- (b) Apply perceptron learning algorithm on NOT classification up to 1 epochs (2 iterations) with initial weight $W_0 = [0.5, 0.3]^T$ and learning rate, $c = 0.5$. 4(CO5)



**Sixth Semester B. E. (Computer Science and Engineering)
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SOFTWARE ENGINEERING

Time : 2 Hours]

[Max. Marks : 40

Instructions to Candidates :—

- (1) All questions carry marks as indicated against them.
- (2) Due credit will be given to neatness and adequate dimensions.
- (3) Assume suitable data and illustrate answers with neat sketches wherever necessary.

1. (a) "Software Engineering is a layered technology". Justify the statement in the light of IEEE definition of software engineering. 3(CO1)
- (b) Explain Quality Function Deployment. How it maximizes the customer satisfaction ? 4(CO1)
2. (a) Describe the evolutionary model proposed by Barry Boehm. Explain how this model embeds prototyping and classic life cycle. 3(CO2)
- (b) Explain scrum model and illustrate in detail. How is it used to solve the problem of blood bank management ? Here donor request, person's details, emergency status, information regarding donor, blood requirement, updates of requirement satisfaction and rejection, further searches and records update are analysed. 4(CO2)
3. (a) Conclude your understanding to explain the steps for top-down integration testing and bottom up integration testing with example. 3(CO3)
- (b) For the following program block,
 - (i) Construct the flow graph.
 - (ii) Determine the cyclomatic complexity using all three methods.

(iii) Determine all independent paths.

```
Procedure Validate_Pin (Valid_Pin, Return_Code)
  Valid_Pin = FALSE
  Return_Code = GOOD
  Pin_Count = 0
  do until Valid_Pin = TRUE or Pin_Count > 2 or
    Return_Code = CANCEL
  begin
    get Pin_Number (Pin_Number, Return_Code)
    if (Return_Code ≠ CANCEL)
      begin
        call Validate_Pin_Number (Pin_Number, Valid_Pin)
        if (Valid_Pin = FALSE) then
          begin
            output "Invalid PIN, please re-enter PIN"
            Pin_Count = Pin_Count + 1
          end
        end
      end
    end
  return (Valid_Pin, Return_Code)
```

4(CO3)

4. (a) Explain the significance of McCall's quality factors. Elaborate on product revision factors. 2(CO3)
- (b) Example : Compute the function point, productivity, documentation, cost per function for the following data :
- (i) Number of user inputs = 24
 - (ii) Number of user outputs = 46
 - (iii) Number of inquiries = 8
 - (iv) Number of files = 4
 - (v) Number of external interfaces = 2
 - (vi) Effort = 36.9 p-m

(vii) Technical documents = 265 pages

(viii) User documents = 122 pages

(ix) Cost = \$ 7744 / month

Various processing complexity factors are :

4, 1, 0, 3, 3, 5, 4, 4, 3, 3, 2, 2, 4, 5.

5(CO3)

5. (a) Giving your understanding on project evaluation, explain its objectives. 3(CO4)
- (b) Describe the relationship between people and effort. 3(CO4)
6. (a) Summarize your understanding on software re-engineering model with diagram. 4(CO4)
- (b) During project management, risk is refined into a set of more detailed risks using risk refinement, why ? 2(CO4)



**Sixth Semester B. E. (Computer Science and Engineering)
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COMPILER DESIGN

Time : 2 Hours]

[Max. Marks : 40

Instructions to Candidates :—

- (1) All questions carry marks as indicated against them.
- (2) Due credit will be given to neatness and adequate dimensions.
- (3) Assume suitable data and illustrate answers with neat sketches wherever necessary.

1. (a) Construct the DFA for the regular expression $a^* b^* (cb)^*$ using the syntax tree method by finding the Nullable, Firstpos and Lastpos. 4 (CO 1)
- (b) Write a regular expression for the following :—
 - (i) Negative decimal floating numbers less than 10 and can have a maximum of 2 digits after the decimal point.
 - (ii) Integer numbers. Comma is allowed as a separator between groups of numbers to make integer easier to read. Number cannot begin or end with comma. 2 (CO 1)
2. (a) Design the LL(1) parsing table for the following grammar :—

$$\begin{aligned} S &\rightarrow ABa \mid b \\ A &\rightarrow cBCD \mid \epsilon \\ B &\rightarrow CdA \mid ad \\ C &\rightarrow eC \mid \epsilon \\ D &\rightarrow bSf \mid a \end{aligned}$$

Check whether the given grammar is LL(1) or not ?
Show the parsing of the string "eeda" and "adb". 8 (CO 2)

OR

- (b) Construct the LR(1) Parsing table for the following grammar :

$$\begin{aligned} A &\rightarrow XYZ \\ X &\rightarrow yY \mid zZ \end{aligned}$$

Contd.

$$Y \rightarrow aZ$$

$$Z \rightarrow bA \mid ZXc$$

Show string parsing for the string "yzac" and state whether the string is valid or invalid for the given grammar. 8 (CO 2)

3. (a) Generate the Three Address Code (TAC) using SDTS for the given language construct.

Show the annotated parse tree and the TAC generated.

while(not(a > b)) do

begin

 if(c > 5) then

 c = c - 1 ;

end

Also give the value of target of S.next. 4 (CO 3)

- (b) Generate the three-address code for following array reference :

$$A[I, J + 1] = B[I, C[I, J]] + D[I, J + 1]$$

Where w = 4 and the size of array A, B, C and D are 10×20 , 10×5 , 5×5 and 10×5 respectively. 4 (CO 3)

4. (a) Discuss Phrase level recovery in LR parser.

Consider the grammar $E \rightarrow E + E \mid E * E \mid (E) \mid id$. The LR parsing table for the given grammar is —

	id	+	*	S	E
0	S2				1
1		S3	S4	accept	
2		R3	R3	R3	
3	S2				5
4	S2				6
5		R1	S4	R1	
6		R2	R2	R2	

Implement the phrase level error recovery routines for the LR parsing and trace the behavior of parser on input id + id * + id. 5 (CO 1)

(b) Identify the phase of compiler where the following error occurs.

(i) `printf("Compiler Design"); #`

The error in the statement is : Illegal character # appears at the end.

(ii) `int x[50], y;`

x = y

The error in the code is : incompatible type of a and b.
1 (CO 1)

5. (a) Consider the given three address code. Generate the program flow graph and state the loops in the program flow. Compute the IN - OUT GEN KILL equation :—

i = m - 1

j = n

a = v1

i = i + 1

j = j - 1

if e1 goto (9)

i = v3

goto (10)

a = v2

If e2 goto (4).

4 (CO 4)

(b) Consider the given Three Address Code, Construct the DAG and perform common subexpression elimination :

t1 = 4 * i

t2 = a [t1]

t3 = 4 * i

t4 = b [t3]

t5 = t2 * t4

t6 = prod + t5

prod = t6

t7 = i + 1

i = t7

if i <= 20 goto 1.

2 (CO 4)

6. (a) Consider the expression $S = (b + c) - ((m + n) - k)$. Generate the target code using getreg() function considering single register. 3 (CO 4)

OR

- (b) Construct the DAG for the following expression : Apply labelling algorithm to find the number of registers required. Also determine the optimal sequence using heuristic algorithm :

$$Z = X - Y + X * Y * U - V / W + X + V.$$

3 (CO 4)

- (c) Apply the gencode algorithm to generate the target code for the following three address code :—

(1) $t1 = c / d.$

(2) $t2 = t1 - f.$

(3) $t3 = b + e.$

(4) $t4 = t2 * t3.$

3 (CO 4)



**Sixth Semester B. E. (Computer Science and Engineering)
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Elective – II

DATA WAREHOUSING AND MINING

Time : 2 Hours]

[Max. Marks : 40

Instructions to Candidates :—

- (1) All questions carry marks as indicated against them.
- (2) Assume suitable data wherever necessary and clearly state your assumptions.

1. (a) Given are the fact table PropertySale (branchNo, .PropertyType, YearMonth, SalesAmount) and dimension table Branch (branchNo, city),

(i) Write SQL statement to answer the following query :

"Retrieve total amount of sale in January and February 2007 in Manchester, Edinburgh, and Birmingham, with subtotals for each property type, month, and city (including all cross-tabular subtotals)"

(ii) What would the following query return ?

```
select PropertyType, YearMonth, city, sum(SalesAmount)
from Branch, PropertySale
where Branch.branchNo=PropertySale.branchNo
and propertySale in('2009-11', '2010-12')
and branch.city in ('Mumbai', 'Pune', 'Nagpur')
group by rollup(PropertyType, YearMonth, city)
```

(iii) What would the following query return ?

```
select PropertyType, YearMonth, city, sum(SalesAmount)
from Branch, PropertySale
where Branch.branch No = PropertySale.branchNo
and propertySale in ('2009-11' , '2010-12')
and branch.city in ('Mumbai', 'Pune', 'Nagpur')
group by cube(PropertyType, YearMonth, city)
```

6(CO1)

2. Consider following dataset showing horsepower and acceleration for cars:

horsepower	24	24	28	28	40	42	48	50	51
acceleration	10.5	27.5	8.8	18.8	32.4	26.9	28.4	28.2	32.2
horsepower	53	55	55	57	58	59	59	61	62
acceleration	35.6	43.5	29.8	34.4	31.2	35.1	33.9	42.2	36.7

- (i) Calculate mean, median and standard deviation for horsepower.
- (ii) Draw Boxplot for horsepower.
- (iii) Perform Z score normalization for horsepower = 55.
- (iv) Calculate Pearson's correlation coefficient. Are these two variables positively or negatively correlated ?

7(CO1)

3. Create Index Organized Table(IOT) named Employee with attributes Emp_No, Emp_Name, Emp_Email and Emp_address. Emp_Email and Emp_address should be in Overflow block. If a secondary index is created on Emp_Name, what will be the contents of this index ? Write the main differences between a heap organized table and IOT.

7(CO2)

4. A database has five transactions. Let min_sup = 2 and min_conf = 60%.

TID	Items
T1	A, B, C
T2	A, B
T3	A, D, E
T4	E, D
T5	E, C
T6	A, D, E

- (i) Apply Apriori algorithm and generate the frequent itemsets.

- (ii) Generate association rules and identify the strongest.

6(CO3)

5. Given the following training dataset (Buy Computer data), identify the root node using information gain and draw the decision tree.

ID	age	income	student	credit_rating	Class: buys_computer
1	<=30	high	no	fair	no
2	<=30	high	no	excellent	no
3	31 ... 40	high	no	fair	yes
4	>40	medium	no	fair	yes
5	>40	low	yes	fair	yes
6	>40	low	yes	excellent	no
7	31 ... 40	low	yes	excellent	yes
8	<=30	medium	no	fair	no
9	<=30	low	yes	fair	yes
10	>40	medium	yes	fair	yes
11	<=30	medium	yes	excellent	yes
12	31 ... 40	medium	no	excellent	yes
13	31 ... 40	high	yes	fair	yes
14	>40	medium	no	excellent	no

7(CO3)

6. Suppose that the data mining task is to cluster points (with (x, y) representing location) into three clusters, where the points are $A_1(2, 10)$, $A_2(2, 5)$, $A_3(8, 4)$, $B_1(5, 8)$, $B_2(7, 5)$, $B_3(6, 4)$, $C_1(1, 2)$, $C_2(4, 0)$. The distance function is Euclidean distance. Suppose initially we assign A_1 , B_1 and C_1 as the center of cluster, respectively. Use the K-means algorithm to show only the three cluster center after the second round of execution..

7(CO4)

