# PRESIDENCY UNIVERSITY
## BENGALURU

**SET B**

# SCHOOL OF ENGINEERING
## END TERM EXAMINATION - JAN 2024

**Semester :** Semester VII - 2020
**Course Code :** CSE3005
**Course Name :** Applied Artificial Intelligence
**Program :** B.Tech.

**Date :** 03-JAN-2024
**Time :** 9:30AM - 12:30 PM
**Max Marks :** 100
**Weightage :** 50%

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**Instructions:**
*(i) Read all questions carefully and answer accordingly.*
*(ii) Question paper consists of 3 parts.*
*(iii) Scientific and non-programmable calculator are permitted.*
*(iv) Do not write any information on the question paper other than Roll Number.*

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## PART A

**ANSWER ALL THE QUESTIONS**                                 **5 X 2M = 10M**

1. Mention the term which describes the set of rules for writing a valid statement in propositional logic.

                                                                      (CO1) [Knowledge]

2. Mentioned the search algorithm that is used to create the distance map.

                                                                      (CO1) [Knowledge]

3. Expand CNF, and mention what each set of disjunctions in the CNF is called.

                                                                      (CO1) [Knowledge]

4. State true or false: In A* search, we select the node which has the lowest heuristic cost among the nodes in the frontier.

                                                                      (CO1) [Knowledge]

5. Mention the type of adversarial search in which there are more than 2 players.

                                                                      (CO1) [Knowledge]

## PART B

**ANSWER ALL THE QUESTIONS**                                 **5 X 10M = 50M**

6. Explain why we traverse the tree in DFS for alpha beta pruning, as opposed to BFS.

                                                                      (CO1) [Comprehension]

7. Solve the N queens problem with N = 5. Your answer must contain the final allotment of the **row numbers** for each of the 5 queens. You must also draw a diagram (5x5 board) of the same.
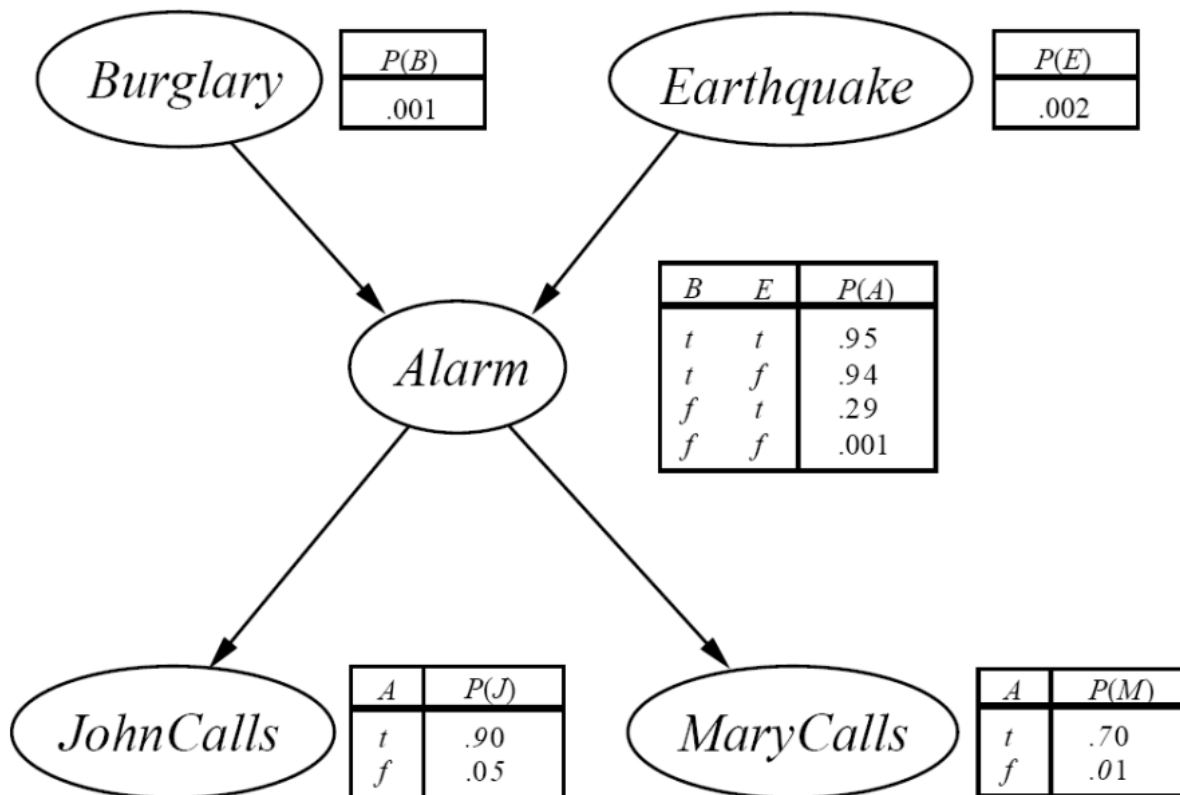
<div align="right">(CO2) [Comprehension]</div>

8. Consider the following situation: "**Alice likes mathematics** and she also likes **literature**. If someone likes mathematics, then they also like **algebra**. If someone likes algebra and also likes **physics**, then they will **graduate**.Alice likes physics, but neither **chemistry** nor **history**. If someone will graduate, their **GPA** is more than 4." For each of the following terms, classify them as either coonstant, variable, predicate, or function. In case it is a predicate or function, **define the predicate / function**:

   1. algebra
   2. Alice
   3. chemistry
   4. GPA
   5. graduate
   6. history
   7. likes
   8. literature
   9. mathematics
   10. physics

<div align="right">(CO3) [Comprehension]</div>

9. Consider the Bayesian Network shown here:



| B | E | P(A) |
|---|---|------|
| t | t | .95 |
| t | f | .94 |
| f | t | .29 |
| f | f | .001 |

| A | P(J) |
|---|------|
| t | .90 |
| f | .05 |

| A | P(M) |
|---|------|
| t | .70 |
| f | .01 |

P(B) .001

P(E) .002

Calculate the probability that a burglary has taken place, given that you **DO NOT** get a call from either John or Mary, that your Alarm is ringing.

<div align="right">(CO4) [Comprehension]</div>

10. Solve the cryptarithmetic puzzle "SEND + MORE = MONEY".

<div align="right">(CO2) [Comprehension]</div>

**11.** Germany is a Federal Republic in Europe. This means that it consists of a number of regions. The different regions of Germany are Brandenburg (BB), Berlin (BE), Baden-Wurttemberg (BW), Bavaria (BY), Bremen (HB), Hesse (HE), Hamburg (HH), Mecklenburg-Vorpommen (MV), Lower Saxony (NI), North Rhine-Westphalia (NW), Rhineland-Palatinate (RP), Schleswig-Holstein (SH), Saarland (SL), Saxony (SN), Saxony-Anhalt (ST), and Thuringia (TH). Their neighbours are as follows:

BB   [BE, SN, NI, ST, MV]
BE   [BB]
BW   [BY, RP, HE]
BY   [BW, HE, TH, SN]
HB   [NI]
HE   [NW, NI, TH, BY, BW, RP]
HH   [SH, NI]
MV   [SH, NI, BB]
NI   [HH, SH, MV, BB, ST, TH, HE, NW, HB]
NW   [RP, HE, NI]
RP   [NW, SL, BW, HE]
SH   [NI, HH, MV]
SL   [RP]
SN   [BY, TH, ST, BB]
ST   [SN, TH, NI, BB]
TH   [BY, HE, NI, ST, SN]

Colour the map of Germany using the LEAST amount of colours from RED, GREEN, BLUE, and YELLOW, using the LRV heuristic, with ties broken using the Degree heuristic. If the ties still persist, then you should resolve them using alphabetical order of the 2-letter region code (Eg. resolving Hesse, which is HE, before Hamburg, which is HH).

(CO2) [Application]

**12.** Consider the coloured ball choosing problem, where we have 100 red balls, 100 green balls and 100 blue balls. Each of the balls are in one of 3 urns, namely Urn1, Urn2 and Urn3, such that all 3 urns have 100 balls. The distribution of the balls in the urns are as follows:

|       | Urn1 | Urn2 | Urn3 |
|-------|------|------|------|
| Red   | 30   | 10   | 60   |
| Green | 50   | 40   | 10   |
| Blue  | 20   | 50   | 30   |

Now, we pick a series of balls from the urns, one at a time, and replace them back in the urns. The probabilities of choosing the ith Urn, given that we chose the (i-1)th Urn are given below (including the initial probabilities which are **NOT 1/3**):

|           | Urn1 | Urn2 | Urn3 |
|-----------|------|------|------|
| $(START) | 0.25 | 0.5  | 0.25 |
| Urn1      | 0.1  | 0.4  | 0.5  |
| Urn2      | 0.6  | 0.2  | 0.2  |
| Urn3      | 0.3  | 0.4  | 0.3  |

For the observation sequence "**B R B G B**", find the sequnce of urns that are chosen which give us this probability.

(CO4) [Application]