Tribhuvan University
Institute of Sciences and Technology
SCHOOL OF MATHEMATICAL SCIENCES
First Assessment 2079

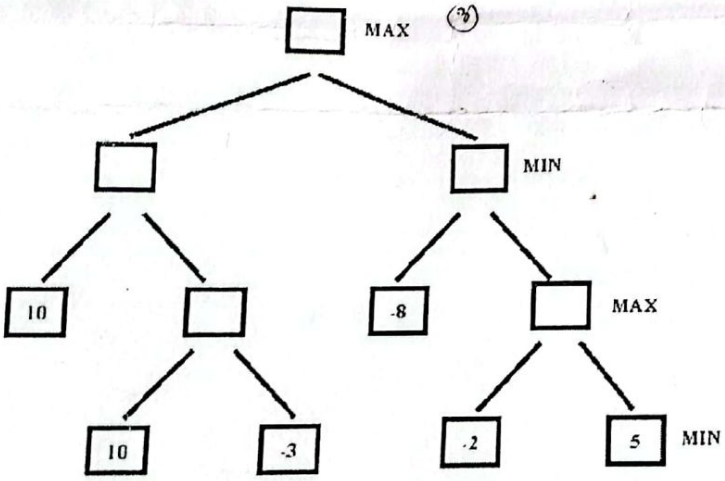
Subject **Artificial Intelligence**
Course No **MDS 556**
Level **MDS /I Year/II Semester**

Full Marks 45
Pass Marks 22.5
Time 2 hrs

Candidates are required to give their answer in their own words as far as practicable.
Attempt ALL Questions.

Group A [5 × 3 = 15]

1. How Turing test is used to measure intelligence from the dimension of acting humanly?
2. Classify which of following is model based, simple reflex, learning, utility based agent. Give a very brief description to your answer.
   a) A disease prediction system
   b) A jurisdiction agent with repository of cases
   c) A game agent with rewards
3. Given following state space, show how Minimax search can be used;



4. How knowledge is inferred in semantic networks? Represent following using semantic network;
   All humans are mammal
   All humans have eyes.
   Weight of Ram, who is human, is larger than weight of Jelly.
   Fishes have red color
   Jelly is a fish and has weight 1pounds
   Ram belongs to QA team from May 1st to May 21st
5. Describe the mathematical model of ANN.

Group B [5 × 6 = 30]

6. How A* search guarantees better solution than greedy best first search? Support your answer by constructing a state space with proper heuristics and actual costs and illustrate that A* returns better path than greedy best first.

OR

Justify A* search guarantees to give solution while greedy best first search does not. Support your answer by constructing a state space with proper heuristics and actual costs and illustrate that A* returns goal but greedy best first does not

7. What is skolemization? Construct FOPL for following statements.

   All students are talent person. Every talent person are smart. Someone who is not smart is dumb. Ram is dumb but he is talent person. Try to infer Ram is student using resolution.

OR

Write resolution algorithm for propositional logic. Construct propositional statements for given knowledge;

MDS is best course in Nepal. If MDS is best course in Nepal then employment in Nepal is high. Employment in Nepal is high and Salary in Nepal is best.

Now using resolution algorithm try to infer that "If MDS is not best course in Nepal and employment in Nepal is high then salary in Nepal is not best".

8. How uncertain knowledge is encoded using Bayesian networks? Consider following scenario, construct equivalent Bayesian network.

   During a medical checkup of a patient, doctor suspects three diseases as the cause of the condition. The suspected diseases are covid, viral, typhoid which are independent of each other. There are four symptoms fever, stiff neck, body pain, cough which the doctor wants to check for presence in order to find the most probable cause of the condition. The symptoms are conditionally dependent to the three diseases as fever depends on all of three, stiff neck depends on typhoid, body pain depends on covid and typhoid, whereas cough depends only on viral. Assume all random variables are Boolean, they are either 'true' or 'false'.

9. Using your own assumptions, configure PEAS framework for;
   a) Weather forecasting agent
   b) Vote counting agent

10. What does learning in ANN means? How perceptron learning is used to train ANN?

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[illegible]

First Re-Assessment 2079

Subject: Artificial Intelligence
Course No: MDS 556
Level: MDS /I Year/II Semester

Full Marks: [illegible]
Pass Marks: [illegible]
Time: [illegible]

Candidates are required to give their answer in their own words as far as practicable.

Attempt ALL Questions.

Group A [5 × 3 = 15]

1. Describe the AI from [illegible] of rationality
2. [illegible]
3. [illegible]
4. [illegible]

   [illegible]

   All students have uniform.

   Height of student Ram is less than height of another student Sita

   [illegible] Blue house

5. Define activation functions and their use in ANN

Group B [illegible]

6. What is uninformed search? How uniform cost search is used, illustrate with an example. [6]

   OR

   How searching is done using Iterative Deepening Search? Illustrate with an example. [6]

7. What is unification and lifting? Try to unify following. [2+4]

   Talent(Ram, X) Talent(Sita, Y)

   Smart(X, Y) Smart(Rita, Z)

   [illegible]

   [illegible] Largest(X, 6)

   OR

   How can you use resolution algorithm in propositional logic? Use resolution for following [2+4]

   Nepal is best country in world. If Nepal is best country in world then Nepal is beautiful. If Nepal is beautiful then tourists in Nepal are high. Nepal is best country or tourists in Nepal are high.

   Now try to infer [illegible]

8. How uncertain knowledge is encoded using Bayesian network? Consider following [illegible] [illegible] Bayesian network [2+4]

During a medical checkup of a patient, doctor suspects three diseases as the cause of the condition The suspected diseases are covid, viral, typhoid which are independent of each other There are four symptoms fever, stiff neck, body pain, cough which the doctor wants to check for presence in order to find the most probable cause of the condition The symptoms are conditionally dependent to the three diseases as fever depends on all of three, stiff neck depends on typhoid, body pain depends on covid and typhoid, whereas cough depends only on viral Assume all random variables are Boolean, they are either 'true' or 'false'

9. Using your own assumptions, configure PEAS framework for; [3+3]
   a. Essay Checking Program
   b. Product Recommendation Agent

10. How back propagation is used to train an ANN? Illustrate the expressions of back propagation for one iteration with an example. [3+3]

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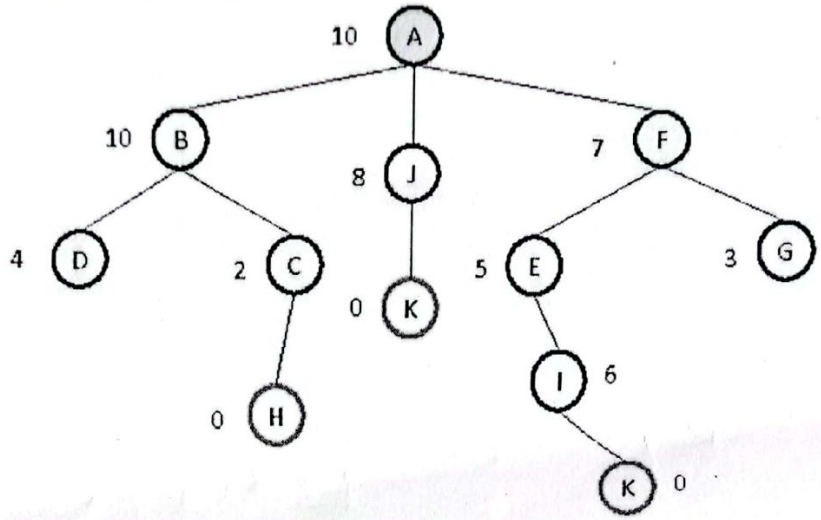
Second Assessment 2079

Subject: **Artificial Intelligence** | *Full Marks:* 45
Course No. **MDS 556** | *Pass Marks:* 22.5
Level: **MDS /I Year/II Semester** | *Time:* 2 hrs

Candidates are required to give their answer in their own words as far as practicable.
Attempt All Questions.

Group A [5 × 3 = 15]

1. How can you define AI from the dimension of acting rationally?
2. Justify with example how episodic environment of agent differs from the sequential environment.
3. Given following state space with start state=A, show how hill climbing search works.



4. What is the significance of pragmatic analysis in NLP?
5. Represent following knowledge using Frames;
   Ram is a student. His roll number is 15. The number of presence of Ram is 15 days. For every students, the marks for regularity is 10% of present days. Ram is enrolled in a course MDS. MDS is a course having 63 credits and it has total 19 courses.

Group B [5 × 6 = 30]

6. How searching approach of iterative deepening is different from depth limited search? Illustrate with appropriate examples. .

OR

How searching approach of DFS is different from BFS? Illustrate with suitable examples.

7. How predicates are converted into CNF form? Convert following into equivalent CNF.
   All girls are smart. Some boys are also smart. All boys who are smart are young. Some girl who is not young is not talent. All boys love girls. Height of all boys is greater than height of all girls.

OR

What is unification and lifting? Why it is important in resolution algorithm? Try to identify unifier or most general unifier for following;

Loves(Ram, Sita)	Loves(Hari, Sita)
Loves(X, Sita)	Loves(Ram,Y)
Loves(X, Sita)	Loves(Ram, X)
Loves(Ram, X)	Loves(Y,Z)

8. What is the significance of Kinematics in robotics? Differentiate direct kinematics from inverse

9. Describe the various types of environments where agent can work.

10. Given following;

Age	Sex	Cholesterol_level	Chest_pain	Heart_Attack_risk
Old	Male	High	Yes	High
Old	Male	Desirable	No	Low
Young	Male	Borderline	No	Low
Young	Male	High	Yes	High
Young	Female	Desirable	Yes	Low
Old	Female	High	Yes	High
Old	Female	Borderline	No	Low

Predict the heart attack risk using Naïve Bayes model for the instance having Age=Old, Sex=Male, Cholesterol=Borderline, Chest_pain=Yes.

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2079
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Master Level / I Year /IInd Semester/ Science
Data Science (MDS 556)
(Artificial Intelligence)

Full Marks: 45
Pass Marks: 22.5
Time: 2 hours

Candidates are required to give their answers in their own words as for as practicable.
Attempt ALL questions.

Group A **[5 × 3 = 15]**

1. How Total Turing Test is used to assess artificial intelligence?

2. How simulated annealing handles the incompleteness problem of hill climbing search?

3. How knowledge is represented in semantic networks? Represent following knowledge using semantic network; [1+2]
   Gunnu is girl and she has fair complexion. Gunnu studies in class one at Gems school. Gems school is a type of private school. The default fee at all the schools is 1000. Alita has obtained A grade which is less than the grade obtained by Gunnu.

4. What is the role of activation function in artificial neural networks? List any two activation functions. [2+1]

5. Describe machine vision with its steps.

Group B **[5 × 6 = 30]**

6. Differentiate informed search from uninformed search. Describe with an example how uniform cost search algorithm works? [2+4]

   OR

   How performance of search algorithm is determined? Describe how searching is done in And-OR search trees? [2+4]

7. How knowledge is inferred in propositional logic? Using resolution, try to infer "Ram is not happy" from the following knowledge base; [2+4]
   If Ram is happy then Ram is healthy. Ram is either athlete or he is student. An athlete is not happy. Ram will go for shopping if he is healthy.

   OR

   What is resolution algorithm in predicate logic? Given following knowledge base; [2+4]

Everyone who has disease is sick. Ram has a disease. Covid is disease. Everyone who have Covid have fever. Now try to infer "Ram is sick and Ram has fever" using resolution.

8. Define intelligent agent. Given following, classify to which agent type they belong [1+5]
   a. A route finding agent which selects path having best path cost.
   b. A COVID prediction agent based on medical history
   c. A Grade calculator based on formula
9. How genetic algorithm works? Given a function $f(x)=x^3$ where x ranges from 0 to 15. Now show a single iteration of genetic algorithm to maximize f(x). Use your own required assumptions. [3+3]
10. How syntax and semantic analysis are done in natural language processing? Support your answer with examples. [4+2]