00040

# The Open University of Sri Lanka
# Faculty of Engineering Technology
# Department of Electrical and Computer Engineering

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| Study Programme | : Bachelor of Technology Honoursin Engineering |
| Name of the Examination | : Final Examination |
| **Course Code and Title** | **: EEX7340- Artificial Intelligence and Agent Technology** |
| Academic Year | : 2020/21 |
| Date | : 02nd February 2022 |
| Time | : 1400-1700hrs |
| Duration | : **3 hours** |

## General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Seven (7) questions** in **Five (5)** pages.
3. Answer any **five(5)**questions only. All questions carry equal marks.
5. Answer for each question should commence from a new page.
6. This is a Closed Book Test**(CBT).**
7. Answers should be in clear hand writing.
8. Do not use Red colour pen.

**Question 1**

**(a)** A house owner is thinking of upgrading her house. When she discussed her requirements with a property developer she was given 3 options as given below to choose from.

**Option1**

A large-scale investment to improve thehouse with a total investment of Rs.1,400,000. At the end this will considerably increase the value of the house. After extensive market research the property developer indicated to her that there is a 40% chance that a profit of Rs. 2,500,000 will be obtained, but there is a 60% chance that it will be only Rs. 800,000.

**Option2**

A smaller scale investmentto re-decorate the house with a less cost around Rs. Rs.500,000. This is less costly but will produce a lower profit. After extensive market research the property developer has identified that there is a 30% chance of a gain of Rs.1,000,000profit but a 70% chance of it being only Rs.500,000.

**Option3**

No investment and improvement to the house. It will have a zero cost and there will be no profit.

Based on the above 3 scenarios answer the below questions.

(i) Draw the decision tree representing the options open to the house owner. (5 marks)

(ii) Add the chance nodes, the probabilities and the outcomes. (4 marks)

(iii) Calculate the expected values and based on the net expected value decide the most suitable option for the house owner. (3 marks)

(iv) Write three(03) decision rules in the form of IF THEN ELSE rules for this scenario. (5 marks)

**(b)** Turing Test and Chinese Room argument proposes two opposing arguments. Compare and contrast the two arguments using an example. (3marks)

**Question 2**

**(a)** For each of the queries below write the output (true, false or a variable binding) that will be given by Prolog when executed.

```
(i)?- X = 5+3.                    (ii)   ?- X is 5+3.
(iii)?- X =5, X is X+3.           (iv)   ?- first\==second.
(v)?-att(cup1, X) = att(Y, white).
(vi)?- [cup, bench, kitchen] =[X|Y].
(vii)?- [c1, on(Y,Z), in(b,k)] = [X, on(X,b)|W].
```

(10 marks)

**(b)** Consider the following prolog program.

```
in(t0, bathroom).
in(f1, bedroom).
in(f2, bathroom).
```

```
in(f3, bathroom).
in(f4, bathroom).

towel(t0).
frock(f1).
frock(f2).
frock(f3).
frock(f4).

clean(t0).
dirty(f1).
clean(f2).
dirty(f3).
clean(f4).

toWash(X):-in(X, bathroom),      format("~n In: ~w", [X]),
           frock(X),             format("~n Frock: ~w", [X]),
           dirty(X),             format("~n Dirty: ~w",[X]),
           fail.
```

(i) What is the output of the following query?

```
|?-toWash(X).
```

(6 marks)

(ii) Suppose a cut were added to the `toWash` predicate (on the second line)

```
toWash(X):-in(X, bathroom), format("~n In: ~w", [X]),
           frock(X),        format("~n Frock: ~w", [X]), !,
           dirty(X),        format("~n Dirty: ~w",[X]), fail.
```

(iii) What would the output of the following query be?

```
|?-toWash(X).
```

(4 marks)

**Question 3**

**(a)** Write the following sentences in Predicate logic.

(i) Some students at OUSL are very smart.

(ii) All dogs are adorable.

(iii) Happy people have healthy lives. (2×3= 6 marks)

**(b)** Convert the following predicate logic expressions into Conjunctive Normal Forms.

(i) $\forall x \forall y(\neg(R(x,y) \wedge \neg R(y,x)))$

(ii) $\exists x \forall x \exists y P(x,y,z)$

(iii) $\forall x \forall y \exists z(\neg R(x, z) \vee \neg (R(y,z)))$ (2×3= 6 marks)

**(c)** Derive by resolution an empty clause from the following clauses (where *x*, *y*, *z* are variables and *a* and *b* are constants)

C1: $[\neg R(x,x)]$

C2: $[\neg R(x,y), R(y,x)]$

C3: $[\neg R(x,y), \neg R(y,z), R(x,z)]$

C4: $[R(a,b)]$ (8 marks)

**Question 4**

A multi-agent system (MAS) is a computerized system composed of multiple interacting intelligent agents.

**(a)**

(i) Briefly explain three characteristics of a multi-agent system.

(ii) "MAS tend to find the accepted solution for their problems through agent communication". Do you agree with this statement. Justify your answer.

(3×2= 6 marks)

**(b)** A student has been asked to develop a multi-agent based e-channeling system, which is capable to connect doctors, patients and channel centers to provide an efficient channel service. According to the scenario a patient can make a channeling appointment and doctors provide consultations through achannel centre.

(i) Create a suitable ontology diagram for the above scenario. (4 Marks)

(ii) Draw a relevant agent diagram for the above scenario. (4 Marks).

(iii) Assume that some patients require channeling a given doctor through the "As soon as channeling option". Draw a suitable communication diagram to communicate with channeling centers and make this appointment. (6 Marks)

**Question 5**

"A multi-agent system is a computerized system composed of multiple interacting intelligentagents within an environment."

**(a)** Briefly explain what is an "Intelligent Agent". (2 marks)

**(b)** Identify which of the following is/are true or false? In each case, justify your answer.

(i) In MAS agents can share knowledge using any agreed language.

(ii) A multi-agent system is always the same as an agent-based model.

(2×2= 4 marks)

(iii) Multi Agent systems are giving less performance for some systems. Briefly explain such a system with an example. (3 marks)

**(c)** Assume that you are required to design a Multi Agent system for a food and grocery delivery company. There is a main distribution centre in each district and under each main distribution centre there are several sub-centres. There are delivery vehicles attached to each centre and all the centres are monitored from the main centre located in the Colombo district. Using Multi Agent approach to this scenario, answer the questions given below.

(i) Identify different kinds of agents suitable for the above scenario with justifications. (3 Marks)

(ii) Briefly describe relevant tasks of each agent. (3 marks)

(iii) Draw a block diagram to show the agent-based system you proposed for the above scenario. (5 marks)

**Question 6**

Consider the below given search space diagram, where S is the initial state and G1 and G2 are the goal states. The cost of moving from one state to the other is given along the edge between the states.The value of the heuristic evaluation function ***h*** applied to the state is the number written inside the state. In the event if a tie occurs choose the state according to the alphabetical order.

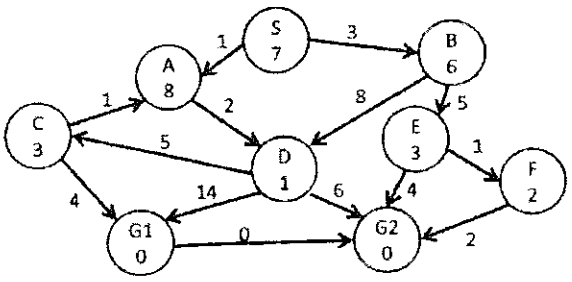



Figure 1- state space diagram

List the nodes of the state space shown in figure 1 in the order of expansion for the following Search algorithms.

**(a)** Depth-first search method. (5 marks)

**(b)** Hill climbing with f(s) = g(s) + h(s) visits. (7 marks)

**(c)** A* visits if it uses f(s) = g(s) + h(s) and give the total cost. (8 marks)

**Question 7**

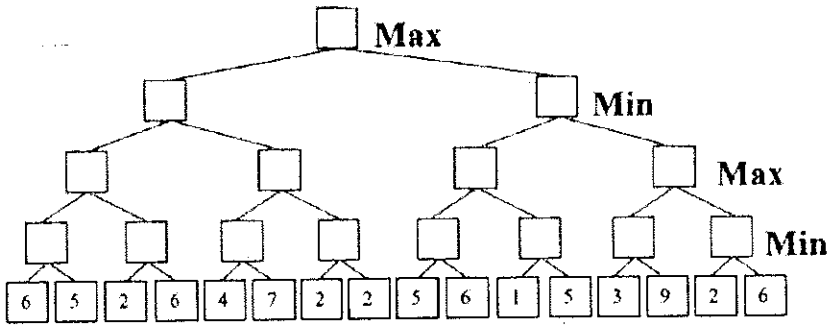
**(a)** There are several knowledge representation mechanisms. Out of those compare and contrast Rule Base systems, Semantic Networks and Frame systems with each other using appropriate examples.

**(b)** Consider the game tree given below in which the first player is trying to maximize the score. The number at the leaves is the values returned by a static evaluator for the board positions reached.

(i) Show the backed-up values in each position of the tree based on the standard min-max algorithm. (10 marks)

(ii) Cross out each node that will not be examined when Alpha-Beta algorithm if applied from left to right. (6 marks)

(iii) Explain why is it not possible to use the standard min-max algorithm for games with an element of chance, such as in gambling. (4 marks)




**End of the Paper**