

The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc/ B. Ed Degree Programme



Department	: Computer Science
Level	: 05
Name of the Examination	: Final Examination (2nd Semester)
Course Title and - Code	: CSU5308/CSU5317 – Artificial Intelligence
Academic Year	: 2020/2021

General Instructions

1. Read all instructions carefully before answering the questions.
 2. This question paper consists of **06** questions in **05** pages.
 3. Answer any **04** questions only. All questions carry equal marks.
 4. Answer for each question should commence from a new page.
 5. Draw fully labelled diagrams where necessary
 6. Involvement in any activity that is considered as an exam offense will lead to punishment
 7. Use blue or black ink to answer the questions.
 8. Clearly state your index number in your answer script
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THE OPEN UNIVERSITY OF SRI LANKA
BSc DEGREE PROGRAMME: LEVEL 05
FINAL EXAMINATION: SEMESTER 2 - 2020/2021
CSU5308/CSU5317: ARTIFICIAL INTELLIGENCE

DURATION: TWO HOURS (2 HOURS)

DATE: 23.03.2022

TIME: 1.30 p.m. to 3.30 p.m.

Answer FOUR Questions ONLY.

Q1.

- (a) Briefly explain the term **Intelligence** in your words. [2 marks]
- (b) Give two (02) **viewpoints/techniques** which had been extracted from the following subject areas to develop Artificial Intelligence.
- (i) Philosophy
 - (ii) Mathematics
- [4 marks]
- (c) Explain the following reasoning techniques with a suitable example for each.
- (i) Deterministic
 - (ii) Dynamic
 - (iii) Non-deterministic
- [6 marks]
- (d) What are the seven (07) types of **reasoning techniques**? [4 marks]
- (e) Which type of reasoning technique is more appropriate to solve each of the following problems? Briefly explain why you select the particular reasoning technique.
- (i) Salespeople receive a short email from a client, asking them to reply quickly about an issue. Also, the client doesn't give enough information to understand before responding.
 - (ii) I must have 90 credits to graduate this academic year. Because I only have 86 credits, I will not be graduating this academic year.

- (iii) You visit your local grocery store daily to pick up necessary items. Two weeks ago on Friday, you noticed that all the clerks in the store were wearing football T shirts. Again, last Friday, the clerks wore their football T shirts. Today, also a Friday, they are wearing them again. From just these observations, you can conclude that on all Fridays, these supermarket employees will wear football T shirts to support their local team.

[9 marks]

[Total = 25 marks]

Q2.

- (a) State whether the following propositional formulas are **tautology**, **contradiction**, or **neither** using the truth tables.

(i) $((A \rightarrow B) \wedge (B \rightarrow \neg A)) \rightarrow A$

(ii) $(\neg(A \wedge B) \leftrightarrow (\neg A \vee \neg B))$

[6 marks]

- (b) Translate $A \vee B \rightarrow (B \leftrightarrow C)$ into **conjunctive normal form**.

[7 marks]

- (c) What is meant by **logical consequence**?

[4 marks]

- (d) Prove that Q is a logical consequence of formulas $P \rightarrow Q$ and P .

[8 marks]

[Total = 25 marks]

Q3.

- (a) Briefly explain the following terms in **First Order Logic** using an example for each.

(i) Variable

(ii) Predicate symbol

(iii) Function symbol

[6 marks]

(b) State whether the following formulas are **well formed formulas**.

- (i) $\forall x \neg P(x)$
- (ii) $\exists x P(R(a, x))$
- (iii) $\forall R(x, a)$

[5 marks]

(c) Find the **prenex normal form** of the following formulas.

- (i) $\exists x [(\forall x P(x)) \wedge \neg R(x)]$
- (ii) $\forall x (\exists y R(x, y) \wedge \forall y \neg S(x, y) \rightarrow \neg(\exists y R(x, y) \wedge P))$

[14 marks]

[Total = 25 marks]

Q4.

(a) What is meant by **agent's percept sequence**?

[2 marks]

(b) List the four (04) **components** used to describe the **task environment**.

[2 marks]

(c) Give the **task environment** for the following automated agents.

- (i) Taxi driver
- (ii) Medical diagnosis system
- (iii) Interactive mathematics tutor
- (iv) Chess game

[8 marks]

(d) Differentiate between **fully observable** and **deterministic** task environments.

[4 marks]

(e) Classify the task environment of four (04) automated agents given in question (c) above, according to the properties: **observable, deterministic, episodic and static**.

[5 marks]

(f) Explain, using diagrams, how the following agents operate.

- (i) Simple reflex agent
- (ii) Model based reflex agent

[4 marks]

[Total = 25 marks]

Q5.

(a) Define **problem solving agent** in your own words.

[3 marks]

(b) Explain why the **problem formulation** must follow the **goal formulation**.

[4 marks]

(c) What is meant by **depth limited search**?

[3 marks]

(d) Give the **standard formulation** of the Blocks World problem under the components: states, initial state, successor function, goal test, and path cost.

[6 marks]

(e) Briefly explain the meaning of **uninformed search strategies**.

[3 marks]

(f) Which of the following are true and which are false? Explain your answers.

- (i) Depth-first search is implemented with an empty first-in first out data structure.
- (ii) Breadth-first search is a special case of uniform-cost search.
- (iii) Breadth-first search is optimal when all step costs are equal.
- (iv) Space complexity of depth-first search is $O(b^d)$, where, b = branching factor, d = depth

[6 marks]

[Total = 25 marks]

Q6.

(a) Explain the difference between the **setof** and **bagof** predicates in Prolog. [4 marks]

(b) What is the difference between the Prolog and other programming languages? [5 marks]

(c) Define the following terms in Prolog using examples.

(i) Atom

(ii) Structure

(iii) Variable

[6 marks]

(d) Considering the following Prolog predicates, answer the queries given in the questions (i) to (iv).

```
plays(flagTwirlers, flags).
plays(plankton, keyboard).
plays(squidward, clarinet).
plays(patrick, mayo).
plays(patrick, drums).
plays(spongebob, drums).
plays(spongebob, spatula).

twoPlayers(X):- plays(Y, X), plays(Z, X), Y \= Z.
talented(X):- plays(X, Y), plays(X, Z), Y \= Z.
```

For each query, list all of the substitution(s)/answers that make the query true. If the query is false or if there are no substitutions, write false.

(i) ?- plays(patrick, X).

(ii) ?- twoPlayers(X).

(iii) ?- talented(X).

(iv) ?- talented(squidward).

[10 marks]

[Total = 25 marks]