AOU
الجامعة العربية المفتوحة
Arab Open University
Faculty of Computer Studies

TM358
Machine learning and artificial intelligence

Midterm Examination (MTA)
Fall Semester 2024/2025

Date: 6/Nov./2024

Number of Exam Pages: 3 (including this cover sheet)	**Time Allowed:** 120 minutes

Instructions:

- Total Marks: **60**
- This exam consists of **2** parts.
- **ALL questions** must be answered in the External Answer booklet.
- Be sure you write your **name and ID** on the External Answer booklet.
- **Calculators** are allowed.

Part -I: Question 1: Choose the best correct answer of all the following: (15 Marks)

1 …… involves a second ground receiver with known location, providing millimeter accuracy under ideal conditions.

A Differential GPS B GPS
C Range finders D Sonar sensors

2 …… the moves that pieces are legally capable of making.

A states B processes
C symbols D None of the above

3 ……. can apply their effectors further afield than anchored manipulators can, but their task is made harder because they don't have the rigidity that the anchor provides.

A Manipulators B Mobile robot
C mobile manipulator D None of the above

4 ……. can be defined as "The sifting out of units whose characteristics and behavior make them less capable of responding successfully to the problems thrown up by their environment"

A adaptation B interaction
C emergence D selection

5 ……. can be defined as "The ability of some unit to alter its longer-term behavior patterns in response to challenges from its environment"

A adaptation B emergence
C selection D interaction

6 …….. such as sonar, send energy into the environment. They rely on the fact that this energy is reflected back to the sensor.

A Passive sensors B rigid sensors
C mobile sensors D Active sensors

7 in the ……., nodes are expanded in the same order in which they are generated

A Best first B DFS
C A* D BFS

8 The technical term for when completing one sub-plan undoes the achievements of another is …….

A Block world B planning
C clobbering D None of the above

9 …….. does not work indoors or underwater.

A Range finders B GPS
C All of the above D Sonar sensors

10 ……. AI is concerned with describing and manipulating our knowledge of the world as explicit symbols, where these symbols have clear relationships to entities in the real world.

A Symbolic B Algebraic
C Sub-symbolic D None of the above

Part-II: Answer all of the following questions (45 Marks).

Question 2: (15 marks)

a. Describe the two main types of search in the context of AI and explain the key differences between them.

b. A tree can be defined by two vectors. The first vector is the parents vector -s. The second vector is the children vector -t. Each entry in t matrix is a child to the corresponding parent in the same index in the s matrix. Assuming s, t in order for a given tree as:

s	A	A	B	B	B	B	C	E	G	G	G	G
t	B	C	D	E	F	G	H	I	J	K	L	M

Given the aforementioned tree, apply DFS to traverse the tree showing all agenda content and traced paths until reaching the goal state if exist assuming that the goal state is F.

Question 3: (15 marks)

a. Explain the characteristics of breadth-first search (BFS) and discuss its advantages and disadvantages.

b. A tree can be defined by two vectors. The first vector is the parents' vector -s. The second vector is the children vector -t. Each entry in t matrix is a child to the corresponding parent in the same index in the s matrix. Assuming s, t in order for a given tree as:

s	A	A	A	B	B	C	C	D	D	D	E	F	F	F	G	G	G	G	H	I	I	I	J	J	J	K	K
t	B	C	D	E	F	G	H	I	J	K	38	16	27	32	15	13	28	31	17	9	35	5	34	43	50	30	48

Given the aforementioned tree, use α-β pruning minimax algorithm to evaluate each node in the tree.

Question 4: (15 marks)

a. Discuss the limitations of the minimax algorithm and explain how it can be improved by adapting the state-value based on the opponent's strategy.

b. Having the following XO sequence of states a long with their values

Assume a learning rate (η) of 0.77 and discount factor (γ) of 0.96, what will be updated values adopting TD-based state value update with each move. Assume all rewards are -1 except for the actions leading to the goal state with respect to X-player.

- O - X X O - O X	0.500
- O - X X O X O X	0.538
- O O X X O X O X	0.590
X O O X X O X O X	1.000

nd of question