

(Form A)

Note: This is 4 pages Exam consisting of Five Questions .

Answer the following question

Question 1: [20 Marks]

Choose the suitable answer

1. The most important feature of agency is
 - a. Autonomy
 - b. Reactivity
 - c. Learning
 - d. Social ability.
2. Classifying emails into Spam or Ham is an application of
 - a. Supervised learning
 - b. Reinforcement learning
 - c. Unsupervised learning.
 - d. None of the above
3. is a graphical modeling language which can be used to design Multi-agent systems.
 - a. Goal.
 - b. STRIPS.
 - c. AUML.
 - d. KQML.
4. The agent which decides what to do with no-reference to its previous run is called.....
 - a. Intelligent Agent.
 - b. Purely reactive Agent.
 - c. decision maker agent.
 - d. Knowledge base agent.
5. In contract Net protocol, the agent that responsible to check "if a bid is accepted " is called
 - a. Initiator .
 - b. Contractor.
 - c. Manager.
 - d. Server Agent.

6. Self interested Agent may communicate with other agent
 - a. True.
 - b. False.
7. In each bidder submits one bid without knowing the others' bids. The highest bidder wins, but with the price of the second highest bid.
 - a. English auction
 - b. Dutch auction
 - c. Vickrey auction
 - d. First price sealed price auction.
8. The performative is suitable for the action "bring the coffee for me"
 - a. Request
 - b. Subscribe
 - c. CFP
 - d. Propose
9. A domain dependent language ,, is used to express the content of messages in Agent Communication language.
 - a. FIPA.
 - b. KQML.
 - c. KIF.
 - d. none.
10. Generating the set of possible actions that an agent can perform is called
 - a. Desires.
 - b. Means-end-Reasoning.
 - c. Filtering.
 - d. Commitment.

Question 2: [25 Marks]

I. The following pseudo-code defines a control loop for a practical reasoning ("BDI") agent.

Agent Control Loop	
1.	$B := B_0;$
2.	$I := I_0;$
3.	while true do
4.	get next precept p
5.	$B := \mathbf{brf}(B, p);$
6.	$D := \mathbf{Options}(B, I);$
7.	$I := \mathbf{filter}(B, D, I);$
8.	$G := \mathbf{Plan}(B, I);$
9.	execute(G)
10.	end while

Question 3: [25 Marks]

I. The following pseudo-code defines a control loop for a practical reasoning ("BDI") agent.

```
Agent Control Loop
1. B := B0;
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3. while true do
4.   get next precept p
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7.   I := filter(B,D,I);
8.   G:= Plan(B,I);
9.   execute(G)
10. end while
```

With reference to this pseudo-code, explain briefly the purpose/role of the following components:

- a. The variables B, D, and I. (3 marks)
- b. The *brf*(...) function. (4 marks)
- c. The *options*(...) function. (4 marks)
- d. The *filter*(...) function. (4 marks)

II. Assume there is an agent willing to sell some product, from your point of view, which Auction Strategy may reward the agent the best price? Show your argument. (10 marks)

Question 4: [20 Marks]

In a particular building, a delivery robot has a goal to pick up and to bring a box which is located at storage. The building consists of several rooms separated by doors. There is a key to unlock these doors. Initially the Key is located at the mailbox. The robot can move from room to room, unlock doors using keys, pick up and put down key or the box.

Assume that the following is a part of the ontology describing the agent based system.

at(Obj,Loc) is true if object Obj is at location Loc.

carrying(Robot, X) is true if robot is carrying X.

sitting_at(Obj,Loc) is true if the object obj is sitting on the ground at location Loc.

unlocked(Door) is true if the door Door is unlocked.

opens(Key,Door) is true if the key Key opens door Door.

adjacent(pos1,pos2) is true if position pos1 is adjacent to position pos2

between(Door,pos1,pos2) if Door is between position pos1 and position pos2.

Given the following part of a BDI program in GOAL

```

knowledge {
  between(door1, o103, lab2).
  opens(k1,door1).
  adjacent(o109,o103).
  adjacent(lab2,o109).
  at(Obj, Pos):- sitting_at(Obj, Pos).
  at(Object, Pos):- carrying(Ag,Obj), at(Ag, pos).
  adjacent(P1,P2):- between (Door, P1,P2), unlocked(Door).
}

beliefs {
  sitting_at(rob,o109), sitting_at(box, storage), sitting_at(k1,mail)
}

goal {
  carrying(rob,box).
}

```

- Using the previous Ontology and the GOAL program, Write the specification of the following actions using STRIPS:
 1. **move(Agent,Pos1,Pos2)** which means the agent can move from pos1 to pos2. (5 marks)
 2. **pickup(Agent, Obj)** which means that the agent picks up the object Obj. (5 marks)
- Given the beliefs set and the knowledge, is the **goal(rob,box)** satisfied ? (2 marks)
- Which action can be applied on the beliefs set ? Write the updated beliefs set after performing the previous action ? (4 marks)
- Taking in consideration the updated beliefs set of the previous question, which action can be applied on the updated beliefs ? Write the new belief set. (4 marks)

Question 5: [10 Marks]

While running the Multi-agent Systems Course, you have assigned a research paper to write a report on it. With a reference to your paper, state its main research problem and summarize the authors contribution to tackle this problem. Be clear and specified, do not assume that the reader knows in advance what you are writing. Don't forget to give title of your paper.

(Form B)

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Question 1: [20 Marks]

Choose the suitable answer

1. In each bidder submits one bid without knowing the others' bids. The highest bidder wins, but with the price of the second highest bid.
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Question 2: [25 Marks]

I. There are only three agents, agent1, agent2, and agent3, participating in an auction to win a particular product. The seller of that product would like to sell it in a price of 100 L.E or to maximize the profit as much as possible. Agent1 bid 75 L.E at time t1, Agent2 bid 77 L.E at time t2 and Agent3 bid 90 L.E at time t3, where $t3 > t2 > t1$. Assume each agent will not bid any price again. In the following Auctions, which agent will win the auction? In what price the agent will win?

- a. English Auction (2 marks)
- b. Dutch (2 marks)
- c. Vickrey (2 marks)

II. A monkey is at location A in a lab. There is a box in location C. The monkey wants the bananas that are hanging from the ceiling in location B, but it needs to move the box and climb onto it in order to reach them.

Assume we are writing BDI program:

- Write the beliefs Base of this program (4 marks)
- Write the Goal base. (4 marks)
- What are the possible actions. (4 marks)
- Specify these actions using STRIPS, (7 marks)

With reference to this pseudo-code, explain briefly the purpose/role of the following components:

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