ML frequent answers

Weak notion of agency (4 feature) +

It describes a set of features that define minimal requirements for something to be considered an agent

* ***Autonomy****: Agents operate without the direct intervention of humans or others, and have some kind of control over their actions and internal state.*
* ***Social Ability****: Agents interact with other agents and (possibly) humans via some kind of agent communication language.*
* ***Reactivity:*** *Agents perceive their environment (which may be the physical world, a user via a graphical user interface, a collection of other agents, the Internet, or perhaps all of these combined), and respond in a timely fashion to changes that occur in it.*
* ***Pro-activity****: Agents do not simply act in response to their environment, they are able to exhibit goal-directed behaviour by taking the initiative*

Speech Act theory (5 categories) +

* *Definition (3 marks):*
  + *The origin of speech act theories are usually traced to the work of the philosopher John Austin.*
  + *Austin noticed that some utterances are like ”physical actions” that appear to change the state of the world. e.g.*
    - *Declaring war*
    - *”I now pronounce you man and wife”*
  + *Austin distinguished 3 different aspects of speech acts:*
    - *Locutionary act - act of making an utterance*
      * *e.g. saying ”please make some tea” ’*
    - *Illocutionary act – action performed in saying something*
      * *e.g. he requested me to make some tea*
    - *Perlocution – effect of the act*
      * *e.g. he got me to make tea*
* *Categories + Examples (10 marks):*
  + *Representatives or assertives (informing) – it is raining*
  + *Directives (requesting) – close the window*
  + *Commisives (committing) – I will close the window*
  + *Expressive (express a mental state) – congratulations*
  + *Declaratives (effect some change) – I now pronounce you man and wife*

Shared space communication ( pro and cons)

*Shared Memory (10 marks):*

* *Central memory store used to manage interaction.*
  + *Can be simple and generic (e.g. tuple spaces)*
  + *Can be complex and task-oriented (e.g. blackboards)*
  + *Distribution and replication can be used to improve reliability*
* *Benefits*
  + *Extensibility: all agents communicate via shared space*
  + *Better for sharing larger quantities of data.*
  + *Supports 1:m (broadcast) type communication*
  + *Easy to monitor and manage system activities*
* *Drawbacks*
  + *Loss of Privacy: information is public*
  + *Information Overload: must deal with large quantities of data*

Agents & Artifacts model, relation with environments, workspaces (check max pdf)

*A&A Model is based on Activity Theory (1 mark),*

*Relationship (2 marks): Environments are workspaces containing artifacts that agents create, share, use, adapt for their work.*

*Concepts (3 marks):*

* ***Agent***

“an encapsulated computer system, situated in some environment, and capable of flexible autonomous action in that environment in order to meet its design objectives.”

*Features (6 marks)*

* Autonomous: Control over internal state and own behaviour.
* Situated: Experiences environment through sensors and acts through effectors.
* Flexible:
  + Reactive: Respond in a timely fashion to environmental change.
  + Proactive: Act in anticipation of future goals.
* ***Artifacts***
  + *Non-autonomous, function oriented entities (controllable and observable)*
  + *Modelling the resources and tools used by agents (designed by MAS programmers; first-class entities for agents)*
* ***Workspaces***
  + *Grouping agents and artifacts*
  + *Defining the topology or the computational environment*
  + Topology refers to the **structure** and **layout** of the workspace, which defines how agents and artifacts interact.

1. “The Agent-Oriented Programming (AOP) paradigm can be viewed as a specialization of the Object Oriented Programming paradigm in which systems are built using agents.” Give Shoham’s table of comparison for AOP and OOP.

**(10 marks)*.***

*Replicate table from notes:*

OOP AOP

Basic Unit Object Agent

Parameters describing unconstrained beliefs, commitments,

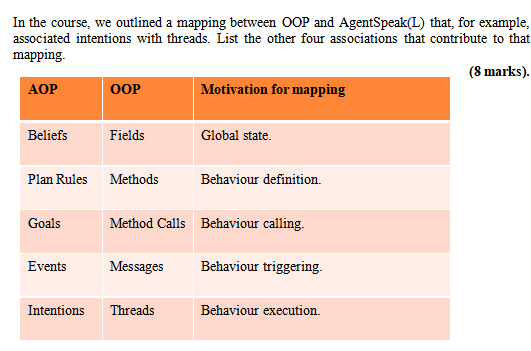
state of basic unit capabilities

Process of Computation message passing and message passing and

response methods response methods

Types of Message unconstrained inform, request, offer

Constrains on Methods none honesty, consistency



1. Explain the association between intentions and threads.

Each intention can be viewed as a **logical thread of execution**

**(7 marks)*.***

* *At a high level,* ***intentions represent the agents efforts at achieving its goals.***
  + *An agent creates a new intention for every external event that it matches to a plan rule.*
  + *An intention is an* ***execution stack that contains the sequence of action*** *that must be performed.*
  + *The next action to be performed is always on top of the stack.*
  + *An execution step involves removing the top item from the stack and executing it.*
  + *This can lead to additional actions being added to the stack (via sub goals).*

**Multiple Intentions**:

* Agents could have **multiple intentions**.
* Each intention has its own execution stack, essentially behaving like a **thread** in a multitasking system.
* *intention execution is* ***interleaved****.*
  + *On each iteration, one intention is selected and executed.*

**Interleaved execution** means that when an agent has multiple intentions , it progresses through them one step at a time in an alternating manner. In each iteration of its decision-making cycle, the agent selects one intention, executes the top action from its stack, and then moves to another intention in the next cycle.

**negotiation phase (auction) between agents + (week7)**

1. AgentSpeak(L) is an abstract Agent-Oriented Programming language that was proposed by Arnund Rao and which is based on the Belief-Desire-Intention architecture. Explain what is meant by beliefs, desires and intentions; describe the relationship between them and explain how these concepts are realized in AgentSpeak(L).
2. **marks)*.***

*Belief, Desire Intention Definitions (3 marks)*

* **Beliefs**: the current state of the environment
* **Desires**: the agent ideal future state of the environment
* **Intentions**: subset of the desires that the agent commits to

*Relationship (4 marks):*

The current state of the environment is represented by the agents beliefs, while the agents desires represent the “ideal” (possibly inconsistent) state of the environment. The agent selects as subset of its desires, which it commits to bringing about and adopts them as intentions. The adopted intentions are mapped to some form of behavior which causes the environment state to change to reflect the intentions (i.e. they become beliefs).

*Realisation in AgentSpeak(L) (3 marks):*

* **Beliefs**: the current state
* **Desires**: represented as goals (assumed to be mutually consistent)
* **Intentions**: represented as plans that have been adopted to achieve goals

1. List and describe the purpose of each of the 4 basic plan operators (statement types) provided in Rao’s AgentSpeak(L) and give example syntax for each one.

* ***Query****: checks if a belief holds w.r.t. the agents belief base – e.g. ?has(X)*
* ***Update****: adds or removes a belief – e.g. +likes(rem, icecream)*
* ***Primitive*** *Action: performs an external action – e.g. kick(ball)*
* ***Sub-goal****: adopts a new (sub) goal – !bookTickets(Event)*