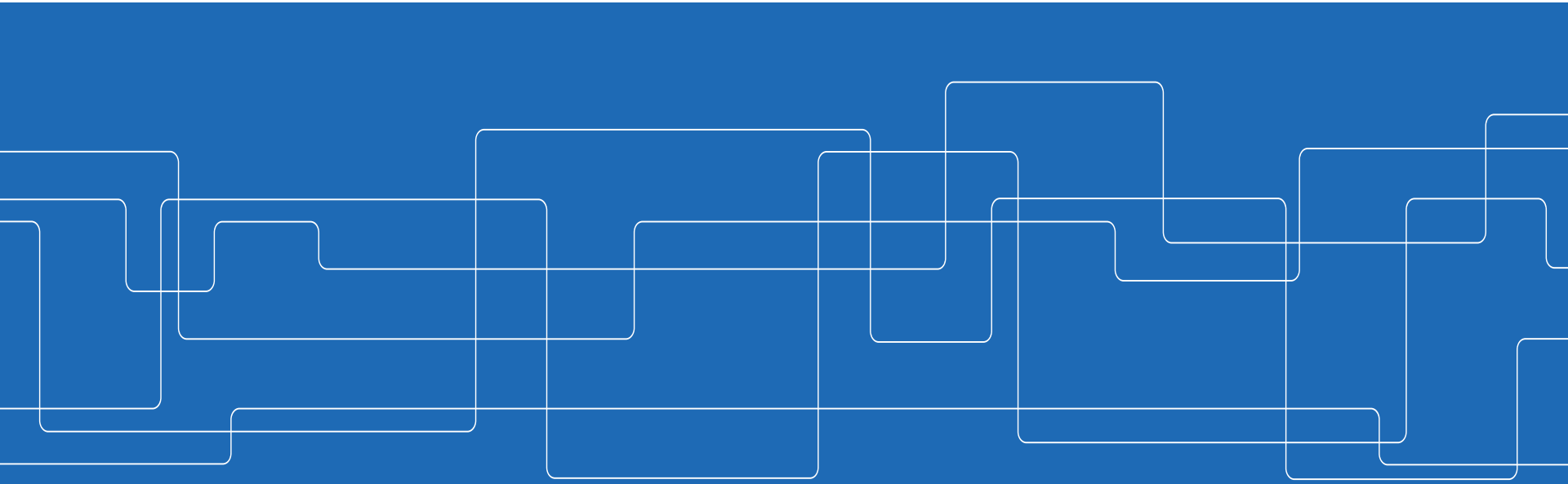
ID2209 Distributed Artifical Intelligence and Intellignet Agents

Homework 2



Homework #2

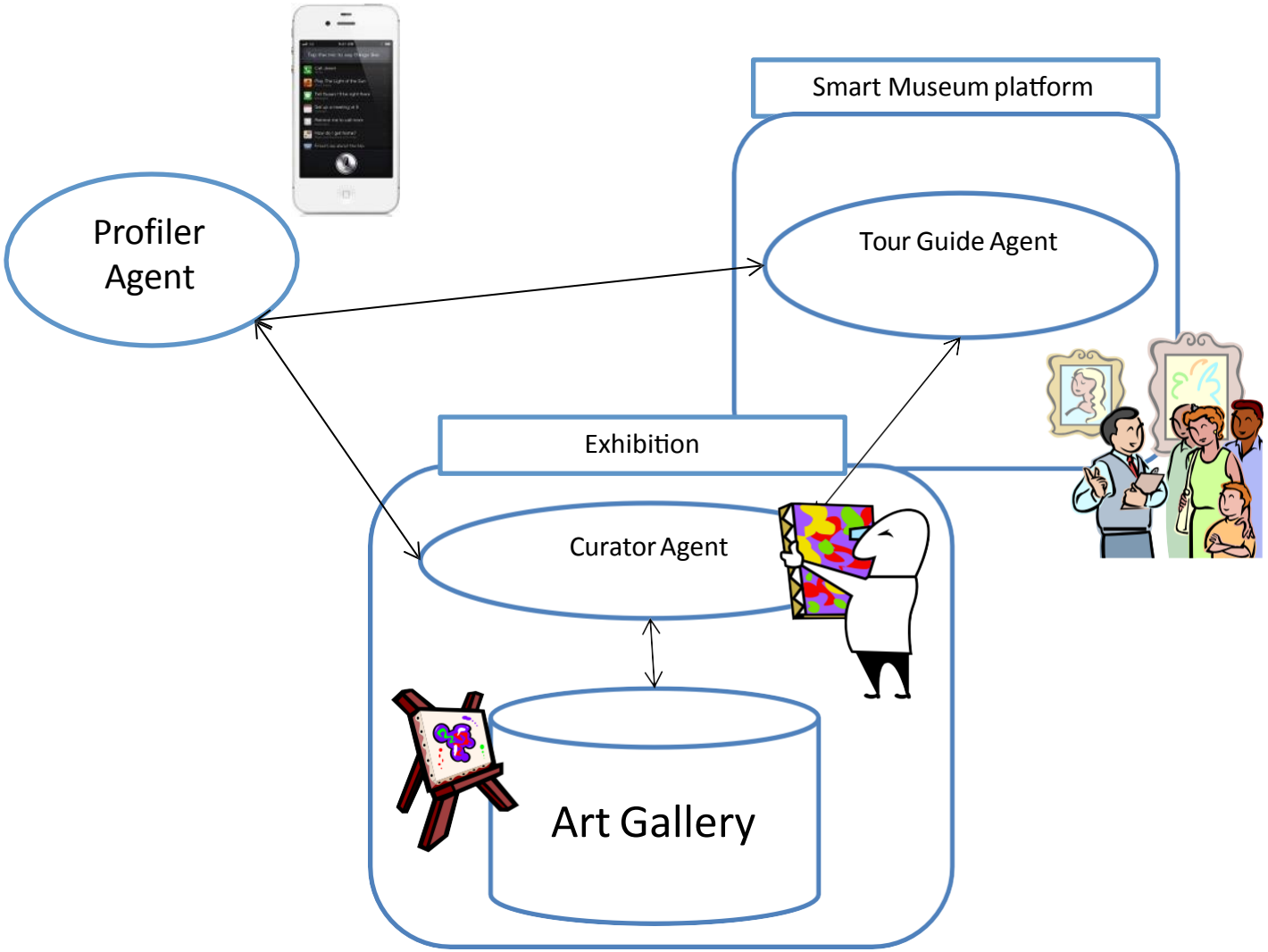
Topics covered in this session:

- Communication in MAS
  - Implementing communication between agent in the museum scenario
- Negotiations in MAS
  - Implementing FIPA Dutch auction in the context of a problem at hand
- Game mechanism design in MAS
  - Computing Utility/Pay-off and establishing Nash Equilibrium in a scenario proposed

-Complementary material

http://www.fipa.org/specs/fipa00032/index.html

SmartMuseum Agent Framework



Task #1

- Using behaviors implemented in HW 1 implement a scenario involving all 3 agents (Profiler, TourGuide, Curator). Possible example:
  - The Profiler Agent interacts directly with Tour Guide Agent to get a personalized virtual tour.
  - The Profile Agent interacts with Curator Agent to obtain detailed information about each of the items stated in the virtual tour.
  - Tour Guide agent interacts with Curator Agent in order to build the virtual tour

FIPA Dutch Auction Interaction Protocol

- The **auctioneer** attempts to find the market price for a good by starting bidding at a price much higher than the expected market value,
  - Then progressively reducing the price until one of the **buyers** accepts the price.
- The rate of reduction of the price is up to the auctioneer. They usually have a reserve price below which not to go.
- If the auction reduces the price to the reserve price with no buyers, then the auction terminates.

FIPA Dutch Auction Protocol

Taken from: http://www.fipa.org/specs/fipa00032/index.html

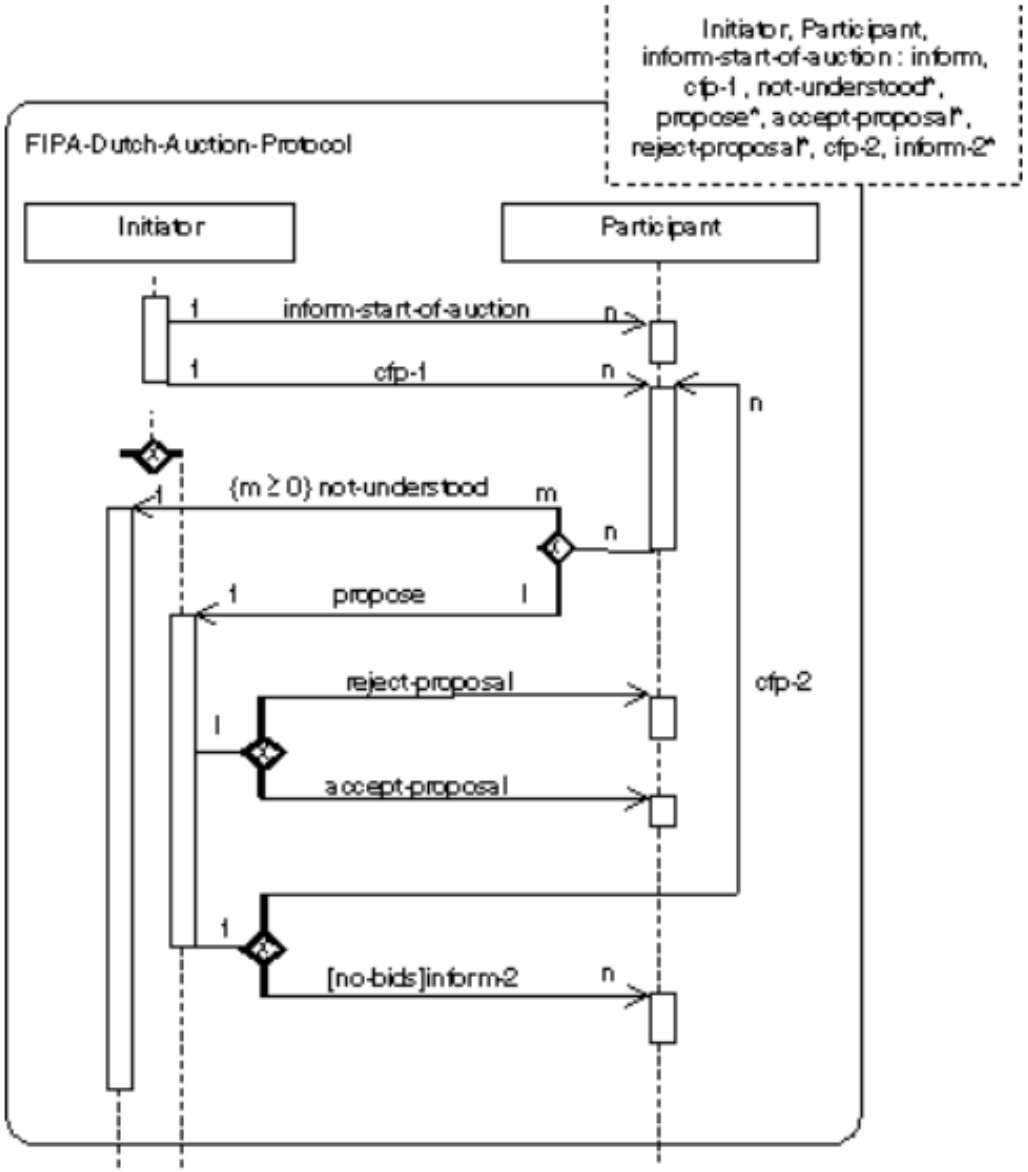


Figure 1: FIPA Dutch Auction Interaction Protocol

Task2: Dutch auction for Smartmuseum

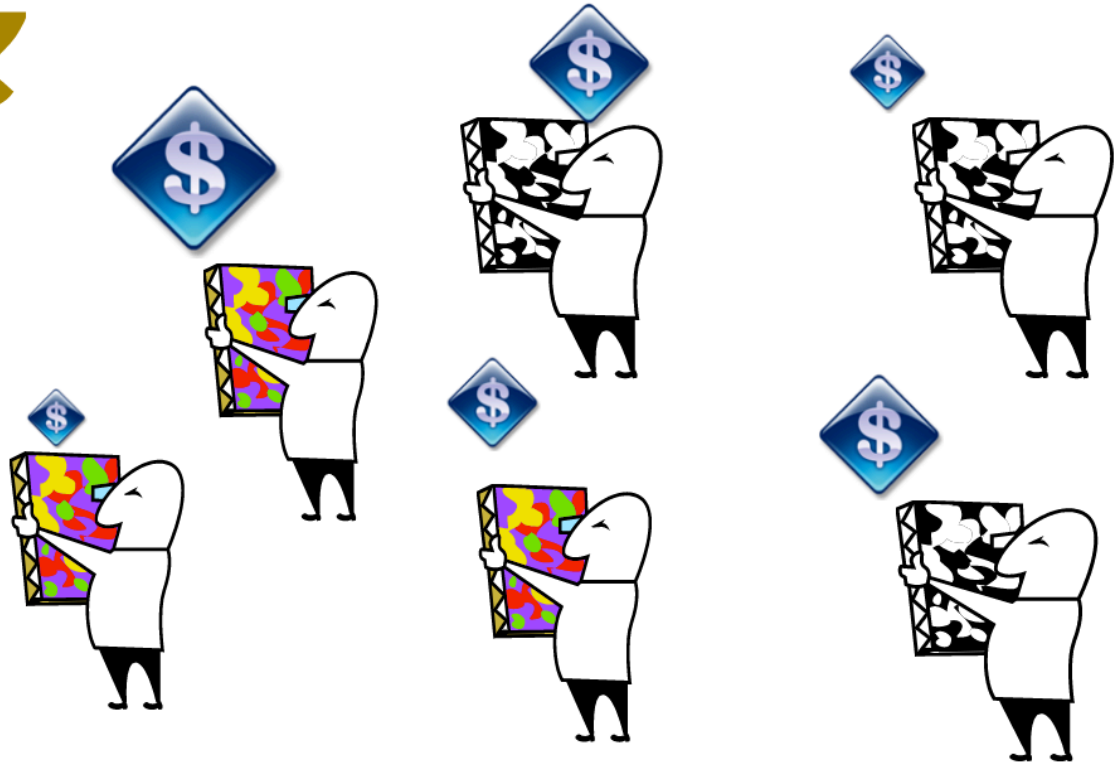
1. - Implement FIPA Dutch Auction Interaction Protocol.
2. - Use the implemented Dutch Auction interaction protocol with your own bidding strategies for the suggested scenarios (shown on the next slides) and show how change of your bidding strategy affects the execution of auctions (e.g. in terms of result and time).

Choose between one of the following scenarios (use at least 4 agents participating in the protocol):

Artist Manager
(also Talent manager)
Agent

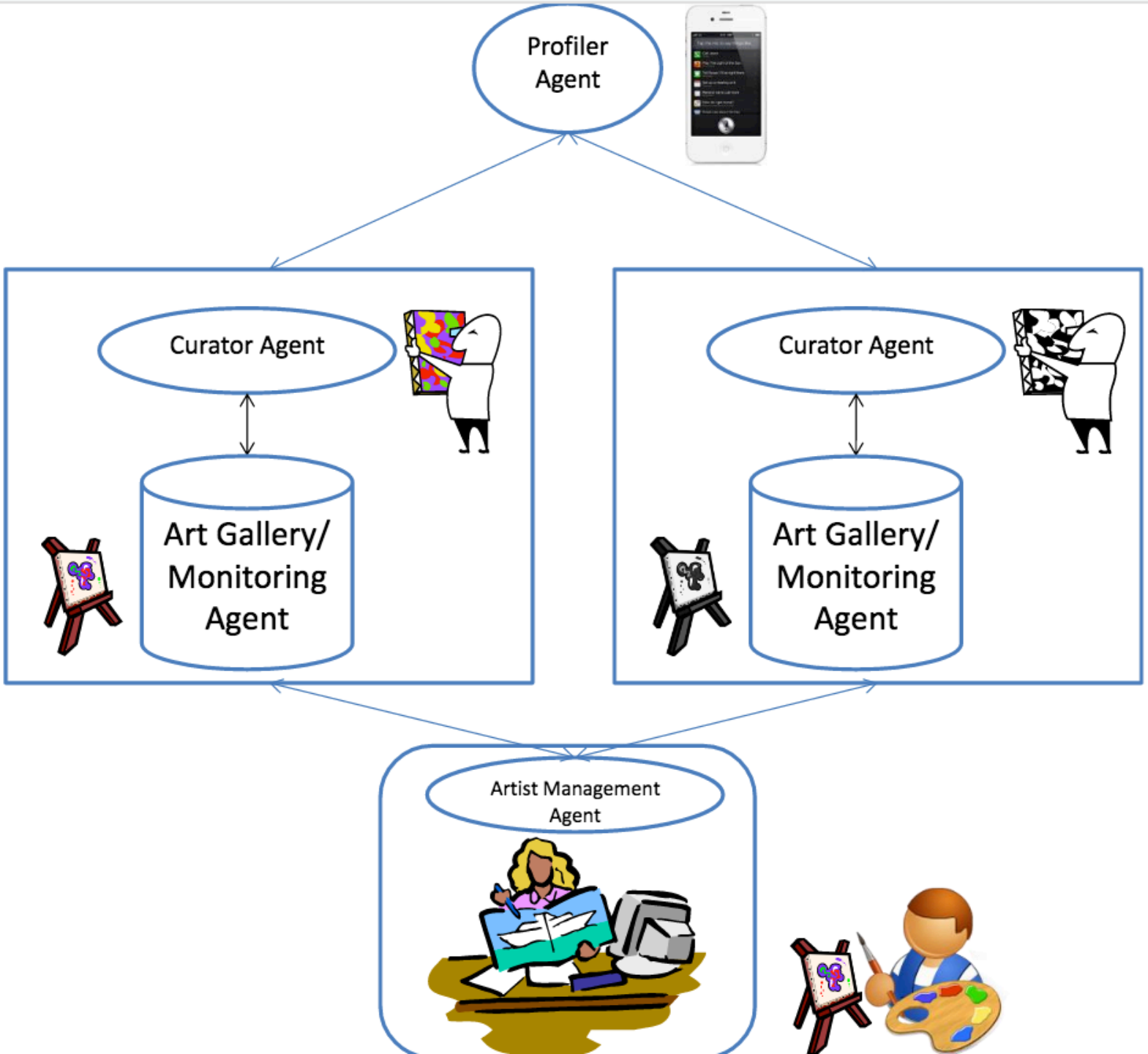
New agent!

Auction
Between artist manager
And curators...



Curator
Agent

OR
Auction between curators and profilers...


Profiler Agent
Curator Agent
Art Gallery/ Monitoring Agent
Curator Agent
Art Gallery/ Monitoring Agent
Artist Management Agent

Task3 assumptions 1/5

We assume that there is **no direct interaction between Profiler agent and Artist Management Agent.**

Various Qualities of Artworks: Paintings example



Images taken from:
http://www.abm-enterprises.net/art_gallery.htm
http://viz.dwrl.utexas.edu/category/tags/mona-lisa-copy
http://commons.wikimedia.org/wiki/File:Mona_Lisa_(copy,_Oslo).JPG

Task3 assumptions 2/5

- **Artist Management** agents correspond to art-producers (painters). So it is responsible for auctioning, managing and selling an artist's products.

- **Artist Management** can decide to sell either a high quality product (the original art work), or a low quality product (such as a poster or copy of an artwork).

Task3 assumptions 2/5

- **Artist Management** quotes the same price for the High Quality and Low Quality product to **curator Agent**.
  - (I.e. Artist Management sells the product at the same price regardless of its quality).
- Of course if Artist manager sells a low-quality product then it will incur a low cost of producing as compared to producing a high-quality product
  - thus if it decides to maximize its profit margin then it will go for a low-quality product.

Task3 assumptions 3/5

- After getting the price from Artist Management Agent, **Curator Agents** quotes the price to **Profiling Agents** (based on some strategy
  - *(a simple case would be quoting a price depending upon the demand and an advanced case is quoting the price depending on the profiled interests).*
- Remember that all curator agents get the same price quote for a certain product from artist management agent.

Task3 assumptions 4/5

- Quality of the product is unknown to **profiling Agent** and **curator Agent.**
  - But of course Artist Management agent knows about the quality of product it is selling.
- **Profiling gent** only knows about the quality when it has bought a product.
  - Of course profiling Agent wants to view a high-quality product, and this has a higher payoff for profiling Agent.
- Viewing a low quality product has a less pay off. And not-viewing a product is also associated with a pay-off.

Task3 assumptions 5/5

- **Artist management Agent** on the other hand wants to maximize its profit. So selling a low quality product gives it a higher payoff (as less cost is incurred in produce a low quality product).
  - Selling the high quality product has a lesser pay off (It costs more to produce the high quality product, but it will sell for the same price).
- If the **Profiling Agent** does not view, then the seller has produced a product and received no revenue. A high quality product will cost more to produce, so not selling a high quality product has a negative pay-off.
  - Not selling a low quality product also incurs a very low or negative pay-off.

Task3

1. Establish pay-offs/utilities for different strategies for Profiling Agent, Curator Agent and Artist Management Agent.

2. Based on the pay-offs try to find Nash equilibrium.

Task3

- This task 3 is a theoretical Question.
- No Implementation is needed.
- Study the lecture notes properly before doing the tasks.

Deliverables

1. Documented text report (explaining what did you do) and source code (with instructions for execution) of implementation of Task#1, Task#2.1 and Task#2.2
2. Documented text report -Task#3

- Deadline: **November 29**
- Upload your homework in Canvas
- A small demo (10 min) of running agents.
- Upload both the documented source code and Report by Deadline specified.

Nash-equilibrium examples (different preferences)

Two firms are merging into two divisions of a large firm, and have to choose the computer system to use. In the past the firms have used different systems, *I* and *A*; each prefers the system it has used in the past. They will both be better off if they use the same system then if they continue to use different systems. We can model this situation by the following two-player strategic game.

To find the Nash equilibria, we examine each action profile in turn.

Player1/ Pl ayer2	I	A
I	2,1	0,0
A	0,0	1,2

Nash-equilibrium examples (opposite preferences)

An established firm and a newcomer to the market of fixed size have to choose the appearance for a product. Each firm can choose between two different appearances for the product; call them *X* and *Y*. The established producer prefers the newcomer's product to look different from its own (so that its customers will not be tempted to buy the newcomer's product) while the newcomer prefers that the products look alike.

Player1/ Pl ayer2	X	Y
X	2,1	1,2
Y	1,2	2,1

Exercise

- Find the Nash equilibria of the following strategic game.

Player1/ Pl ayer2	X	Y
X	2,2	0,0
Y	0,0	1,1

Nash-equilibrium

- **The rule goes as follows: if the first payoff number, in the payoff pair of the cell, is the maximum of the column of the cell and if the second number is the maximum of the row of the cell - then the cell represents a Nash equilibrium.**
  - (This rule does not apply to the case where mixed (stochastic) strategies are of interest)

Example

	A	B	C
A	0,0	25,45	5,10
B	40,25	0,0	5,15
C	10,5	15,5	10,10