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|  | **Royal Institute of Technology**  **MSc. Software Engineering of Distributed Systems** |

ID2209 Distributed Artificial Intelligence and Intelligent Agents

Homework 2

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|  |
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# Question 3

Pay-offs in the tables are put in this order:

|  |  |  |
| --- | --- | --- |
|  |  | Manufacturing agent |
|  | Pricing agent |  |
| Shopping agent |  |  |

## First case

The pay-offs table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **High quality** | | | **Low quality** | | |
|
|
| **Buy, high price** |  |  | 3 |  |  | 10 |
|  | 8 |  |  | 5 |  |
| 10 |  |  | -1 |  |  |
| **Buy, low price** |  |  | 3 |  |  | 10 |
|  | 5 |  |  | 4 |  |
| 17 |  |  | 1 |  |  |
| **Not buy, high price** |  |  | -3 |  |  | -1 |
|  | -2 |  |  | -1 |  |
| -1 |  |  | 3 |  |  |
| **Not buy, low price** |  |  | -3 |  |  | 1 |
|  | -1 |  |  | 0 |  |
| -4 |  |  | 2 |  |  |

### Explanation

#### Manufacturing Agent

We suppose that manufacturing low quality product give more pay-off to Manufacturing agent than manufacturing high quality product if products are selling. If products are not selling Manufacturing agent lost 3 in case of high quality products and only 1 in case of low quality products.

#### Pricing Agent

Pricing agent can set high or low price for the products. Generally pricing agent prefers to sell high priced products but if they are not selling it lost more. Pricing agent also prefers sell high quality products but low quality products are better in case of bad sells.

#### Shopping Agent

For Shopping agent the main thing is quality. It prefers to buy high quality products even with high price. It’s better for him not to buy low quality item than buy it.

## Nash Equalibrium for the first case

In the following table we can see all possible strategies of all agents and check if this is Nash equilibrium.

|  |  |
| --- | --- |
| **cases** | **is equilibrium** |
| buy, high price, high quality | false |
| buy, high price, low quality | false |
| buy, low price, high quality | false |
| buy, low price, low quality | false |
| not buy, high price, high quality | false |
| not buy, high price, low quality | false |
| not buy, low price, high quality | false |
| not buy, low price, low quality | true |

## Second Case

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **high quality** | | | **low quality** | | |
|
|
| **buy, high price** |  |  | 3 |  |  | 2 |
|  | 8 |  |  | 4 |  |
| 10 |  |  | 2 |  |  |
| **buy, low price** |  |  | 3 |  |  | 5 |
|  | 5 |  |  | 3 |  |
| 17 |  |  | 5 |  |  |
| **not buy, high price** |  |  | -3 |  |  | -1 |
|  | -2 |  |  | -1 |  |
| -2 |  |  | 1 |  |  |
| **not buy, low price** |  |  | -3 |  |  | -1 |
|  | -1 |  |  | 0 |  |
| -6 |  |  | 0 |  |  |

### Explanation

#### Shopping Agent

* The pay off values (and the utilities) for buying a low quality item increased because now they have the alternative to return the product.
* The pay off values (and the utilities) for not buying a low quality item decreased because it is now less risky to buy a product.

#### Manufacturing Agent

* The pay off values (and the utilities) for producing a high quality product remained the same.
* The pay off values (and the utilities) for producing a low quality product decreased because if the Shopping Agent buys a product, then there is the chance that they will return the product.

#### Pricing Agent

* The pay off values (and the utilities) for selling high or low remained relatively the same, but they both decreased in the case that the product is a low quality product, because they also loose from a possible return of a product.

## Nash Equilibrium for the second case

In the following table we can see all possible strategies of all agents and check if this is Nash equilibrium.

|  |  |
| --- | --- |
| **cases** | **is equilibrium** |
| buy, high price, high quality | true |
| buy, high price, low quality | false |
| buy, low price, high quality | false |
| buy, low price, low quality | false |
| not buy, high price, high quality | false |
| not buy, high price, low quality | false |
| not buy, low price, high quality | false |
| not buy, low price, low quality | false |

* (buy, high price) → high quality  
  (buy, high quality) → high price  
  (high price, high quality) → buy
* (buy, high price) → high quality  
  **NO**
* (buy, low price) → low quality  
  (buy, low quality) → high price  
  **NO**
* (not buy, high price) → low quality  
  (not buy, low quality) → low price  
  **NO**
* (not buy, low price) → low quality  
  (not buy, low quality) → low price  
  (low price, low quality) → buy  
  **NO**