	Politecnico di Milano Facoltà di Ingegneria dell'Informazione **Internet Monetization** Exam July 7 2014		LAST NAME AND FIRST NAME
	ROW	COLUMN	STUDENT ID

- The exam is composed of three stapled sheets printed on both sides.
- This front page must be filled with last name, first name, ID number, position (row and column communicated by the instructor), and signature.
- Exams without a completely filled front page or with missing sheets will not be considered. Answers can be written only on these sheets. If you need more space, please write on the last page.
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- All the answers must be justified.

SIGNATURE

Exercise 1 (7 points).

1.1 How can the problem of finding the best assignment be formulated in mathematical programming fashion?

1.2 What is the complexity of finding the best assignment?

1.3 Apply the Hungarian algorithm to find the best assignment in the following problem.

3	2	5	3
4	3	1	2
3	5	2	1
4	4	3	3

Exercise 2 (7 points). Given the following combinatorial auction problem:

Agents:	1, 2, 3, 4, 5
Items:	a, b, c, d
Bids:	agent 1 bid = (v = 3, S = {a, b, c})
	agent 2 bid = (v = 4, S = {b, d})
	agent 3 bid = (v = 1, S = {a})
	agent 4 bid = (v = 5, S = {a, b, c, d})
	agent 5 bid = (v = 3, S = {a, c})

2.1 Find the best allocation of items to agents by means of the branch-and-bound algorithm.

2.2 What is the complexity of solving a combinatorial auction in general settings? And when agents are single-minded? In this last case, is there a polynomial time mechanism? If yes, apply it.

Exercise 3 (6 points).

3.1 What is a double auction?

3.2 When applied to double auctions, is the VCG mechanism truthful (aka incentive compatible)?

3.3 Is it possible to obtain truthfulness, individual rationality and weak budget balance in double auctions? If yes, describe the mechanism that assures these properties.

Exercise 4 (6 points). Given a finite, discounted Markov Decision Process and a policy, describe how to compute the value of that policy for each state. Discuss advantages and disadvantages of the different methods.

Exercise 5 (6 points).

5.1 Describe the Upper Confidence Bound (UCB) algorithm.

5.2 Consider the following online advertisement problem: Every time a user visits your homepage you may choose one ad to display among two. Every time the first ad is clicked you get 1€, while you get 0.5€ for the second one. You do not know the Click Through Rates (CTRs), but you have collected the following data: the first ad has been clicked 40 times out of 80 impressions, while the second has been clicked 2 times out of 5 impressions. Which ad will be shown next time using UCB1?

	Politecnico di Milano Facoltà di Ingegneria dell'Informazione **Internet Monetization** Exam July 21 2014		LAST NAME AND FIRST NAME
	ROW	COLUMN	STUDENT ID

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SIGNATURE

Exercise 1 (7 points). Consider the assignment problem.

1.1 How can the problem of finding the best assignment be formulated in mathematical programming fashion?

1.2 What is the complexity of finding the best assignment?

1.3 Apply the Hungarian algorithm to find the best assignment in the following problem.

0	2	4	2
3	6	1	3
2	5	2	1
4	2	3	0

Exercise 2 (6 points). Describe the model of markets with intermediaries. Describe the perfect competition situation and the monopoly situation. Report an example of hybrid competition. What is the social welfare in a market with intermediaries?

Exercise 3 (6 points).

3.1 What are sponsored search auctions? Describe the formal model.

3.2 Describe three different user models for sponsored search auctions (position dependent, ad dependent, position/ad dependent externalities) ?

3.3 Describe the algorithm to find the best allocation with the ad-dependent externalities.

Exercise 4 (7 points). Describe the Value Iteration algorithm. Consider a simple MDP with two states (s1 and s2) and two actions (a1 and a2). The reward function is R(s1,a1) = 5, R(s1,a2) = 10, R(s2,a1) = R(s2,a2) = -1. The state transition model is P(s1| s1,a1) = P(s2|s1,a1) = 0.5, P(s1|s1,a2) = P(s2|s2,a1) = P(s2|s2,a2) = 1 and all the other transition probabilities are zero. Starting from a value function initialized to zero and considering a discount factor equal to 0.9, what is the value function after two iterations of the Value Iteration algorithm?

Exercise 5 (6 points). What is the Gittins index and what it is used for?

	Politecnico di Milano Facoltà di Ingegneria dell'Informazione **Internet Monetization** Exam September 4 2014		LAST NAME AND FIRST NAME
	ROW	COLUMN	STUDENT ID

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SIGNATURE

Exercise 1 (6 points).

1.1 What is an economic mechanism?

1.2 What are the notable properties of an economic mechanism?

1.3. What are the Groves mechanisms?

Exercise 2 (7 points). Solve the following double auction problem with the VCG and subsequently with the McAfee auction (in the strictly budget balanced version, if possible).

Sellers: $s1 = 0, s2 = 2, s3 = 2, s4 = 4$
Buyers: $b1 = 5, b2 = 4, b3 = 3, b4 = 3$

Exercise 3 (7 points).

3.1 Introduce the models about population cascades.

3.2 Describe the direct-effect cascade model.

3.3 Describe network games with strategic complements and strategic substitutes.

Exercise 4 (6 points). Describe the Q-learning algorithm.

Exercise 5 (6 points). Describe the epsilon-greedy exploration strategy and explain its pros and cons.

	Politecnico di Milano Facoltà di Ingegneria dell'Informazione **Internet Monetization** Exam September 18 2014		LAST NAME AND FIRST NAME
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SIGNATURE

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4	3	1	2
3	5	2	1
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Exercise 2 (7 points). Given the following combinatorial auction problem:

Agents:	1, 2, 3, 4, 5
Items:	a, b, c, d
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2.1 Find the best allocation of items to agents by means of the branch-and-bound algorithm.

2.2 What is the complexity of solving a combinatorial auction in general settings? And when agents are single-minded? In this last case, is there a polynomial time mechanism? If yes, apply it.

Exercise 3 (6 points).

3.1 Introduce the models about population cascades.

3.2 Describe the direct-effect cascade model.

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Exercise 4 (6 points). Describe the differences between Q-learning and SARSA algorithms.

Exercise 5 (6 points). Describe the differences between UCB and EXP3.

	Politecnico di Milano Facoltà di Ingegneria dell'Informazione **Internet Monetization** Exam February 19 2015		LAST NAME AND FIRST NAME
	ROW	COLUMN	STUDENT ID

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