CS 6100 Spring 2010
Exam 1  100 points

Fill in the blank (1 point each)

1. In game theory, _______________________ describes a situation in which a participant's gain or loss is exactly balanced by the losses or gains of the other participants.
2. _______________________ agents do not simply act in response to their environment; they are able to exhibit goal-directed behavior by taking initiative.
3. The difference between objects and agents is that objects do it for free, agents to it ________________________
4. A two player game is termed ______________________, if one player gets the same as the other player if the roles are reversed.
5. An outcome o is _______________________ if there exists no other outcome o’ such that some agent has higher utility and no agent has lower utility in o’.
6. In _______________________ voting, the single choice (having more votes than other choices) is selected
7. If a player plays cooperatively at first, but once the other layer defects, the player defects from then on, it is termed ________________________ strategy.
8. ________________________ produces a social choice ordering in which the number of unhappy arcs (in the majority graph) is minimized.

Multiple Choice (3 points) Pick the single best answer.

1. The existence of two Nash equilibria implies
   a. Either solution is equally good.
   b. The dominant strategy is to choose either solution.
   c. The solutions are pareto optimal.
   d. none of the above

2. Consider for following payoff matrix.

   \[
   \begin{array}{c|cc}
   & j \text{ defects} & j \text{ cooperates} \\
   \hline
   i \text{ defects} & 3, 3 & 2,4 \\
   i \text{ cooperates} & 1,1 & 4,2 \\
   \end{array}
   \]

   Which is true?
   a. CC is a Nash Equilibrium
   b. the dominant strategy for j is to cooperate
   c. CD (i cooperates, j defects) is pareto efficient (no one can do better without making someone worse)
   d. all of the above

3. Consider for following payoff matrix.
<table>
<thead>
<tr>
<th>J defects</th>
<th>J cooperates</th>
</tr>
</thead>
<tbody>
<tr>
<td>I defects</td>
<td>2,2</td>
</tr>
<tr>
<td>I cooperates</td>
<td>0,5</td>
</tr>
</tbody>
</table>

Which is true?
- a. CC is a Nash Equilibrium
- b. the dominant strategy for J is to defect
- c. DD is Pareto efficient (no one can do better without making someone worse)
- d. all of the above

4. What is the dilemma in the Prisoner’s Dilemma?
- a. Confessing is better than remaining silent, but both confessing is not the best option.
- b. Because you can’t talk to your partner, you don’t know what to do.
- c. You don’t know if the other person will retaliate if you defect.
- d. There is no equilibrium.

5. An environment which changes only by actions of the agent is termed
- a. accessible
- b. static
- c. continuous
- d. deterministic

6. An agent which perceives and reacts to changes in their environment but does not have a symbolic representation of the world and does not use complex symbolic reasoning are termed
- a. functional
- b. reactive
- c. decentralized
- d. intentional

7. The notation used by the book $R^E \rightarrow Ac$ defines
- a. an agent
- b. an action
- c. history of the run
- d. the next function

8. Normal utilities show a degree of happiness. Quality of solution would require what type of utility?
- a. cardinal
- b. ordinal
- c. preference function
- d. predicate utility

9. The principle of utility monotonicity is also referred to as
- a. transitivity
b. decomposability
c. substitutability
d. free disposal

10. Which is not one of Arrow's desirable conditions
   a. The social choice ordering should exist for all inputs
   b. The social preference ordering should be unaffected by manipulation
   c. The social choice ordering should be independent of irrelevant alternatives
   d. The social choice order should be asymmetric and transitive.
   e. All are members of Arrows desirable conditions

11. In a version of battle of the sexes, the outcome matrix is

<table>
<thead>
<tr>
<th>Opera (p)</th>
<th>Opera (q)</th>
<th>Football (1-q)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opera (p)</td>
<td>3.2</td>
<td>1.1</td>
</tr>
<tr>
<td>Football (1-p)</td>
<td>0,0</td>
<td>2,3</td>
</tr>
</tbody>
</table>

How many pareto optimal solutions are there
   a. 0    b. 1    c. 2    d. 3    e. 4

12. In Battle of the sexes (show above), how many Nash equilibria solutions are there
   a. 0    b. 1    c. 2    d. 3    e. 4

13. In Battle of the sexes (shown above), what is the mixed strategy equilibrium (in terms of the probability each plays Opera, probability each plays Football)
   a. (.5,.5) b. (.75, .25) c( .4, .6) d. (.66, .33) e. None of the above

14. Consider the following preferences functions in a Borda voting protocol. The function A>B means A is preferred to B.
   Agent 1: A > B > C
   Agent 2: B > C > A
   Agent 3: C > A > B
   Agent 4: A > C > B
   Agent 5: B > A > C
   Agent 6: B > A > C

How can agent 6 lie about his preference to get an advantage?
   a) He votes B > C > A
   b) He votes A > C > B
   c) He vote A > B > C
   d) He cannot improve the results by lying.

15. In Battle of the sexes (shown above), what is the best response function for player 2 (y), given player 1's mixed strategy (x)?
16. In the version of the Worker/Monitor game, the outcomes are

<table>
<thead>
<tr>
<th></th>
<th>Monitor (q)</th>
<th>No Monitor (1-q)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

f. None of the above
Work (p) | 50,80 | 50,100
Shirk (1-p) | 0,-20 | 100,-100

What is the mixed strategy equilibrium for p and q:

a. (0,0)  
b. (.8, .5)  
c. (.5, .5)  
d. (.2,.8)  
e. (.8, .8)  
f. None of the above

17. Consider the prisoners dilemma game (shown below). Iterative play randomly chooses two players from a population of players of type all-defect or tit-for-tat. Assume that 50% of the players are all-defect and that random partners play each other five times in an interaction. What is the expected utility for each player type:

| a. 1.4 All-defect | 2.4: tit-for-tat |
| b. 1 All-defect    | 2: tit-for-tat   |
| c. 1.5 All-defect  | 1.5: tit-for-tat |
| d. 2.1 All-defect  | 2.2: tit-for-tat |
| e. 1.8 All-defect  | 2.5: tit-for-tat |
| f. None of the above |

18. Given the utilities of the following coalitions, what is a core solution?

<table>
<thead>
<tr>
<th>Coalition</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>{1,2}</td>
<td>5</td>
</tr>
<tr>
<td>{1,3}</td>
<td>4</td>
</tr>
<tr>
<td>{1,4}</td>
<td>4</td>
</tr>
<tr>
<td>{2,3,4}</td>
<td>6</td>
</tr>
<tr>
<td>{1,2,3,4}</td>
<td>8</td>
</tr>
</tbody>
</table>

a) (3,2,2,1) (payment for agents 1,2,3,4, respectively)  
b) (2,3,2,2) (payment for agents 1,2,3,4, respectively)  
c) (3,2,1,2) (payment for agents 1,2,3,4, respectively)  
d) none of the above

19. If every voter ranks c before d, then c should be before d in the social choice ranking is an statement of which principle:

a. Condorcet Winner Condition  
b. Stable set  
c. Fair Results  
d. Pareto Optimal  
e. Independence of Irrelevant alternatives

20. For the majority graph shown below, who is the Condorcet Winner?
Short Answer

1. (6 points) In the diagram below which shows the outcomes for player 1 (x) and player 2 (y), circle the outcomes.

   a. a 
b. b 
c. c 
d. d 
e. There is no Condorcet Winner
3. (9 points) One can delete rows or columns which are dominated (strongly or weakly) by other rows or columns interactively to identify the Nash equilibria.
   
   (a) Using this strategy, what happens in the case below?
   (b) Is this stable? Why or why not?
   (c) Is this Pareto optimal? Explain

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5,2</td>
<td>2,6</td>
<td>1,4</td>
<td>0,4</td>
</tr>
<tr>
<td>B</td>
<td>0,0</td>
<td>3,2</td>
<td>2,1</td>
<td>1,1</td>
</tr>
<tr>
<td>C</td>
<td>7,0</td>
<td>2,2</td>
<td>1,5</td>
<td>5,1</td>
</tr>
<tr>
<td>D</td>
<td>9,5</td>
<td>1,3</td>
<td>0,2</td>
<td>4,8</td>
</tr>
</tbody>
</table>