Directions: For questions 1-7, neatly circle or otherwise indicate the correct choice. To receive credit on problem 8, show all work and continue to the next page if necessary.

Questions 1 and 2 refer to the following game tree:

1. (5 points) How many different pure strategies does player 1 have in this game?
   (a) 2
   (b) 3
   (c) 6
   (d) 8
   (e) 16

2. (5 points) How many different pure strategy profiles are there in this game?
   (f) 8
   (g) 10
   (h) 12
   (i) 16
   (j) 32
Questions 3, 4, and 5 refer to the following game in matrix form:

<table>
<thead>
<tr>
<th>player 1</th>
<th>player 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W  X  Y  Z</td>
</tr>
<tr>
<td>A</td>
<td>3,2 1,1 4,3 3,5</td>
</tr>
<tr>
<td>B</td>
<td>1,3 3,0 2,4 4,2</td>
</tr>
<tr>
<td>C</td>
<td>2,1 0,1 1,2 1,0</td>
</tr>
<tr>
<td>D</td>
<td>1,0 2,0 3,1 4,0</td>
</tr>
</tbody>
</table>

3. (10 points) What are player 2's best responses to the belief that player 1 plays A with probability one half and C with probability one half?

(k) A is player 2's only best response.
(l) Y is player 2's only best response.
(m) Z is player 2's only best response.
(n) Y and Z are both best responses.
(o) none of the above.

4. (10 points) Which of the following statements are true?

(p) A dominates C, Y dominates W, and B dominates D.
(q) A dominates C, W dominates X, and Y dominates X.
(r) A dominates C, Y dominates W, and Y dominates X.
(s) A dominates C, Y dominates Z, and B dominates D.
(t) A pure strategy cannot be dominated by another pure strategy.

5. (15 points) Which profile of mixed strategies is a mixed strategy Nash equilibrium? Note: Read player 1's strategies from top to bottom and player 2's strategies from left to right. That is, \( \sigma_1 = (\sigma_1(A), \sigma_1(B), \sigma_1(C), \sigma_1(D)) \) and \( \sigma_2 = (\sigma_1(W), \sigma_1(X), \sigma_1(Y), \sigma_1(Z)) \).

(a) \( \sigma_1 = (\frac{1}{2}, \frac{1}{2}, 0, 0) \) and \( \sigma_2 = (\frac{1}{2}, \frac{1}{2}, 0, 0) \).
(b) \( \sigma_1 = (\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0) \) and \( \sigma_2 = (0, 0, \frac{1}{2}, \frac{1}{2}) \).
(c) \( \sigma_1 = (\frac{1}{2}, \frac{1}{2}, 0, 0) \) and \( \sigma_2 = (0, 0, \frac{1}{2}, \frac{1}{2}) \).
(d) \( \sigma_1 = (\frac{1}{2}, 0, 0, \frac{1}{2}) \) and \( \sigma_2 = (0, 0, \frac{1}{2}, \frac{1}{2}) \).
(e) \( \sigma_1 = (\frac{1}{2}, 0, 0, \frac{1}{2}) \) and \( \sigma_2 = (0, 0, \frac{1}{2}, \frac{1}{2}) \).
Questions 6 and 7 refer to the following game in matrix form:

\[
\begin{array}{cccccc}
 & K & L & M & N & O & P \\
\hline
\text{player 1} & & & & & & \\
AA & 2,0 & 2,1 & 3,2 & 0,0 & 0,0 & 0,0 \\
BB & 3,1 & 4,4 & 1,2 & 0,0 & 0,0 & 0,0 \\
CC & 5,4 & 1,5 & 2,5 & 0,0 & 0,0 & 0,0 \\
DD & 0,0 & 0,0 & 0,0 & 2,2 & 1,1 & 2,1 \\
EE & 0,0 & 0,0 & 0,0 & 1,7 & 0,8 & 1,9 \\
FF & 0,0 & 0,0 & 0,0 & 1,1 & 0,9 & 9,0 \\
\end{array}
\]

6. (10 points) Which of the following strategy profiles is NOT a Nash equilibrium?

(f) \( (AA,M) \)
(g) \( (BB,L) \)
(h) \( (CC,K) \)
(i) \( (DD,N) \)
(j) All of the above are Nash equilibria.

7. (15 points) Which of the following strategies for player 2 is NOT rationalizable?

(v) \( L \)
(w) \( M \)
(x) \( N \)
(y) \( O \)
(z) All of player 2’s strategies are rationalizable.
8. (30 points)
Two firms are playing a game of Cournot (quantity) competition. Denoting the quantity chosen by firm 1 as \( q_1 \) and the quantity chosen by firm 2 as \( q_2 \), the market price is given by the inverse demand equation

\[ p = 100 - q_1 - q_2. \]

The firms' cost functions exhibit increasing marginal costs, where a firm's cost is the square of its output. That is, for \( i = 1, 2 \), firm \( i \)'s cost of producing \( q_i \) units of output is \((q_i)^2\). Each firm's payoff is defined to be its profit.

(a) (10 points) Find the best-response functions of each firm.
(b) (15 points) Find the Nash equilibrium strategy profile for this game.
(c) (5 points) Find the profits received by each firm at the Nash equilibrium.