This was Exercise 4.2 in the textbook

1. (a) $2^3 = 8$.  (b) $2^4 = 16$.  (c) Four.

For (d) and (e), the following is true for every value of $K$:

- In the simultaneous subgame on the left, producing low output is a strictly dominant strategy for the Entrant and producing low output is a strictly dominant strategy for the Incumbent. Thus (low output, low output) is the unique Nash equilibrium.

- In the simultaneous subgame on the right, producing low output is a strictly dominant strategy for the Entrant and producing high output is a strictly dominant strategy for the Incumbent. Thus (high output, low output) is the unique Nash equilibrium.

Using the above we can simplify the game as follows:

Thus

(d.1) If $K = 6$ the Entrant comes in at the left node and stays out at the right node and the subgame-perfect equilibrium is as follows: the Entrant’s strategy is (in, out, low output, low output), the Incumbent’s strategy is (large plant, low output, high output).

(d.2) At the subgame-perfect equilibrium the Entrant’s payoff is 0 and the Incumbent’s payoff is 20.

(e.1) If $K = 14$ the Entrant stays out at both nodes and the subgame-perfect equilibrium is as follows: the Entrant’s strategy is (out, out, low output, low output), the Incumbent’s strategy is (small plant, low output, high output).

(e.2) At the subgame-perfect equilibrium the Entrant’s payoff is 0 and the Incumbent’s payoff is 25.
This was similar to (a simplified version of) an example I discussed in class

2.

(a) The game is as follows with \( r = 0.4, \ b = 150, \ c = 30. \)

(b) The strategic form is as follows (the payoffs are, of course, expected payoffs):

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>120</td>
<td>72</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>90</td>
<td>-18</td>
</tr>
</tbody>
</table>

(c) For Player 1 \( A \) is a strictly dominant strategy.

(d) For Player 2 \( B \) is a strictly dominant strategy.

(e) The only Nash equilibrium is \((A,B)\).

(f) Since there are no proper subgames, every Nash equilibrium is also a subgame-perfect equilibrium and vice versa. Thus there are no Nash equilibria that are not subgame-perfect equilibria.