Business Statistics 41000: Assignment 2

Due in Class of Week 3

1. **Google Problem.**

Visitors to your website are asked to answer a single survey question before they get access to the content on the page. Among all of the users, there are two categories

   1. Random Clicker (RC)
   2. Truthful Clicker (TC)

There are two possible answers to the survey: yes and no.

Random clickers would click either one with equal probability. You are also giving the information that the expected fraction of random clickers is 0.3.

After a trial period, you get the following survey results. 65% said Yes and 35% said No.

- How many people people who are truthful clickers answered yes?

2. **Expectation and Strategy**

An oil company wants to drill in a new location. A preliminary geological study suggests that there is a 20% chance of finding a small amount of oil, a 50% chance of a moderate amount and a 30% chance of a large amount of oil.

The company has a choice of either a standard drill that simply burrows deep into the earth or a more sophisticated drill that is capable of horizontal drilling and can therefore extract more but is far more expensive. The following table provides the payoff table in millions of dollars under different states of the world and drilling conditions

<table>
<thead>
<tr>
<th>Oil</th>
<th>small</th>
<th>moderate</th>
<th>large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Drilling</td>
<td>20</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Horizontal Drilling</td>
<td>-20</td>
<td>40</td>
<td>80</td>
</tr>
</tbody>
</table>
Find the following

1. The mean and variance of the payoffs for the two different strategies
2. The strategy that maximizes their expected payoff
3. Briefly discuss how the variance of the payoffs would affect your decision if you were risk averse
4. How much are you willing to pay for a geological evaluation that would tell you with certainty the quantity of oil at the site prior to drilling?

3. Bayes: Gold and Silver Coins

A chest has two drawers. It is known that one drawer has 3 gold coins and no silver coins. The other drawer is known to contain 1 gold coin and 2 silver coins. You don’t know which drawer is which. You randomly select a drawer and without looking inside you pull out a coin. It is gold. Show that the probability that the remaining two coins in the drawer are gold is 75%.

4. The Monty Hall Problem.

This problem is named after the host of the long-running TV show, Let’s Make a Deal.

A contestant is given a choice of 3 doors. There is a prize (a car, say) behind one of the doors and something worthless behind the other two doors (say two goats). After the contestant chooses a door Monty opens one of the other two doors, revealing a goat. The contestant has the choice of switching doors. Is it advantageous to switch doors or not?

5. Probability and Lotteries

The Powerball lottery is open to participants across several states. When entering the powerball lottery, a participant selects five numbers from 1-59 and then selects a powerball number from the digits 1-35. In addition, there’s a $1 million payoff for anybody selecting the first five numbers correctly.

- Show that the odds of winning the Powerball Jackpot are 1 in 175,223,510.
- Show that the odds of winning the $1 million are 1 in 5,153,632.

On February 18, 2006 the Jackpot reached $365 million. Assuming that you will either win the Jackpot or the $1 million prize, what’s your expected value of winning?

- Mega Millions is a similar lottery where you pick 5 balls out of 56 and a powerball from 46. Show that the odds of winning mega millions are higher than the Powerball lottery

On March 30, 2012 the Jackpot reached $656 million. Is your expected value higher or lower than that calculated for the Powerball lottery?