Ch6 Final Project - Testing For Treatment

Code

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Step 1

Part 1

I will investigate the Cologuard test because it has a nice false-positive rate of 10%. The expected number of false positives in a group of five patients is 5 x 0.1 = 0.5

I will simulate 20 groups of 5 tests using R's built in random number function. 1 means a false positive and 0 means no false positive.

Code

```
 Group   Test 1   Test 2   Test 3   Test 4   Test 5   Total
     1        0        0        0        0        0      0
     2        0        0        0        0        1      1
     3        0        1        0        0        0      1
     4        0        0        1        0        0      1
     5        0        0        0        0        0      0
     6        0        0        0        0        0      0
     7        0        0        1        0        1      2
     8        1        0        0        0        0      1
     9        0        1        0        1        0      2
    10        0        0        0        0        0      0
    11        0        0        0        0        0      0
    12        0        0        0        0        1      1
    13        0        0        1        0        0      1
    14        0        0        0        0        1      1
    15        0        0        0        0        0      0
    16        0        0        0        0        0      0
    17        0        0        0        0        0      0
    18        0        0        1        0        0      1
    19        0        0        0        0        0      0
    20        0        0        0        0        0      0
```

Part 2

From the simulated results above, I created this probability distribution:

Code

```
X    0   1   2   3 4 5
P(X) 0.5 0.4 0.1 0 0 0
```

Code

```
[1] "The simulated expected number of false positives(mean) is 0.6"
```

Code

```
[1] "The simulated variation of false positives(standard deviation) is 0.680557047378721"
```

Expected value = 0.5 x 0 + 0.4 x 1 + 0.1 x 2 + 0 x 3 + 0 x 4 + 0 x 5 = 0.6

Standard deviation = sqrt((0-0.6)^2 x 0.5 + (1-0.6)^2 x 0.4 + (2-0.6)^2 x 0.1) = 0.681

Step 2

To find the mean and standard deviation of X x 2100, I simply multiply the mean and standard deviation by 2100

Code

```
[1] "The simulated expected unnecessary cost(mean) is 1260"
```

Code

```
[1] "The simulated variation of unnecessary costs(standard deviation) is 1429.16979949531"
```

Step 3

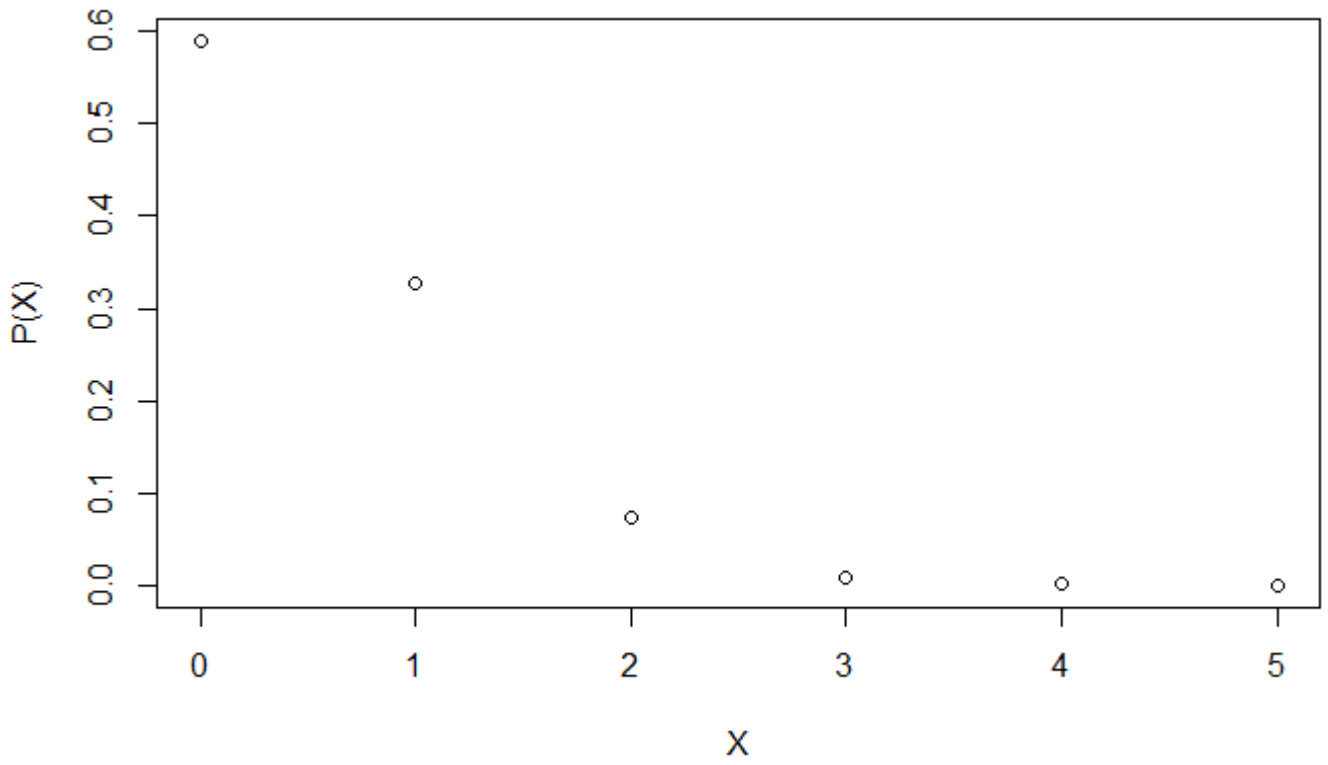
Part 1

I created this probability distribution from the binomial distribution formulas, not a simulation.

Code

```
X    0       1       2      3      4       5
P(X) 0.59049 0.32805 0.0729 0.0081 0.00045 1e-05
```

Code



1. It is in the shape of a binomial distribution
2. The expected number of false positives in a group of 5 is 0.5. 5 x 0.1 = 0.5
3. They were quite close to each other, with the simulated value being 0.6. This is less than 1/4 standard deviations away.

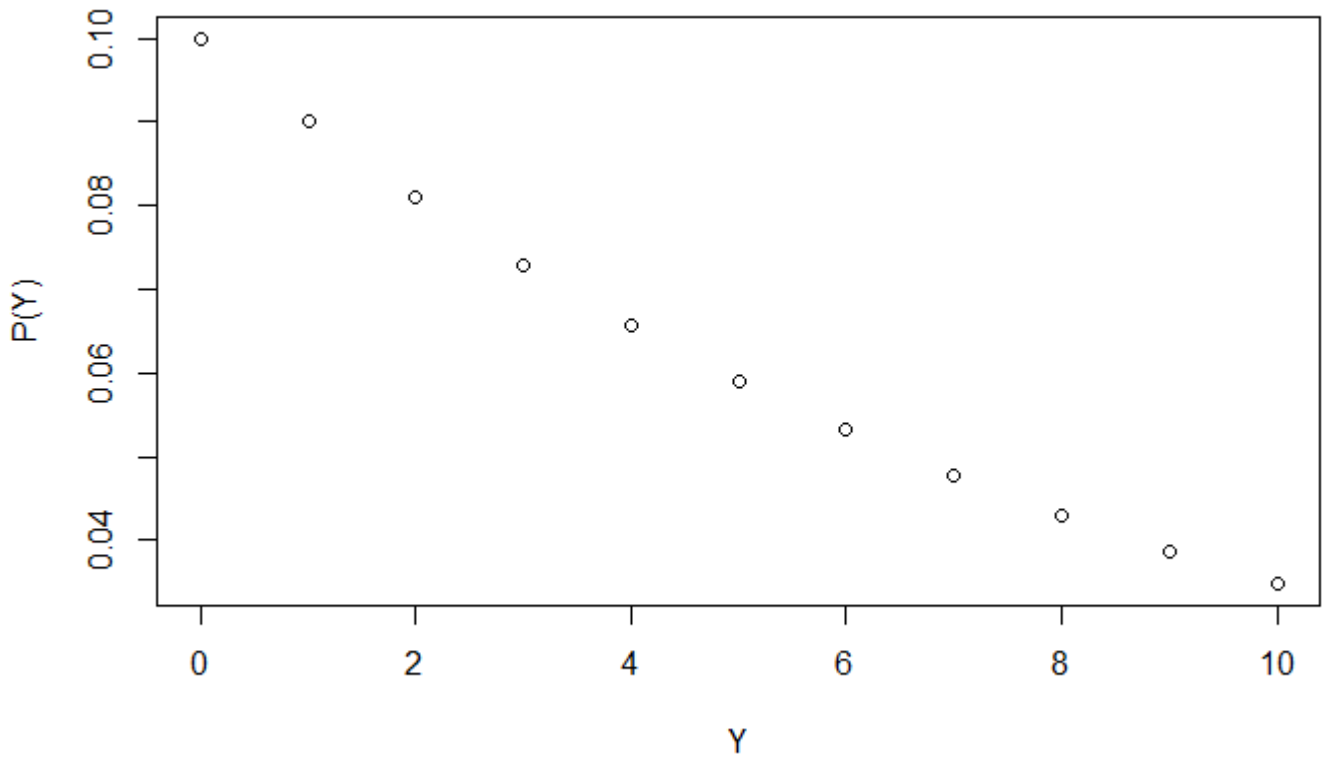
Part 2

This probability distribution is the probability that each trial is the first false positive.

Code

```
Y    0   1    2     3      4       5        6         7          8           9           10
P(Y) 0.1 0.09 0.081 0.0729 0.06561 0.059049 0.0531441 0.04782969 0.043046721 0.0387420489 0.0348
6784401
```

Code



1. It is in the shape of a geometric distribution
2. The expected number of tests to get a false positive is 10. 1/0.1 = 10

Conclusion

In conclusion, I recommend the Cologuard test. It only has a 10% chance of giving a false positive, thus the expected number of tests before you get a false positive is 10. Also, the predicted unnecessary cost is $210 per test ($252 according to simulations), and over 5 tests, $1050 ($1260 according to simulations). I'd say that is a reasonable price for detecting colon cancer that could otherwise be fatal.