CS 559 HW1

1.

Utility of winning given that you bet is final amount in bank for win (W) minus the original amount (B)

U(win | bet) = W - B

Utility of losing given that you bet is final amount in bank for loss (L) minus the original amount (B)

U(loss | bet) = L - B

So net utility is shown below

U(bet)=Pw*U(win, bet)+Pl*U(lose, bet)

=Pw*(W-B)+(1-Pw)*(L-B)

One must maximize utility such that U(bet)>0 so one is very likely to win

U(bet)>0 ➔ Pw*(W - B) + (1 - Pw)*(L - B) > 0

Pw*W - Pw*B + L - B - Pw*L +Pw*B > 0

Pw*W - Pw*L + L - B > 0

Pw*W - Pw*L > B - L

Pw*(W - L) > B - L

Pw > (B - L) / (W - L)

So as long as probability is greater than (B - L) / (W - L) one should bet

2.

For the green wallet, the probability to pull a dime followed by two pennies= (4/10) * (6/9) * (5/8) = 1/6

For the black wallet, the probability pulled a dime followed by two pennies= (2/10) * (8/9) * (7/8) = 7/45

Given that the probability to use green wallet is 4/5 and black wallet is 1/5 from past experience

For the green wallet, the P=

(4/5 * 1/6) / (4/5 * 1/6) + (1/5 * 7/45) = 2/15 / (2/15 + 7/225) = 2/15 / 37/225 = 30/37 = .8108

For the black wallet, the P=

(1/5 * 7/45) / (4/5 * 1/6) + (1/5 * 7/45) = 7/225 / (2/15 + 7/225) = 7/225 / 37/225 = 7/37 = .1891

Given that P(error | wallet used) = min (P(green, coins) , P(black, coin))

Probability that you are wrong is the probably you pick black walleyed .1891

3.

We know that sum of independent Gaussian is Z = X+Y ➔ N(Mean x+Mean y, Variance x + Variance y)

Using the mean and instance of both function the expected mean should be

N1*Mean1+N2*Mean2/Net N = (1*2000+4*1000) / (2000+1000) = 2

The combine variance should be sum(all value - 2)^2 / 3000

The combine variance can be expressed by n1*variance1^2+n2*variance2^2+n1*(mean1-mean3)^2+n2*(mean2-mean3)^2

Resulting in 8000+9000+2000+4000/3000 = 7.66666

Pretty close to the result of python