***Prob 1:***

Let, X be the random variable denoting the total money in the bank account.

* Given, current value of X is B

We assume that the bet will be taken if the Expected value of bank account sum(if bet is taken) exceeds B (the current amount ).

* Given, if bet is won, the amount in bank = W
* Given, if bet is lost, the amount in bank = L
* Probability of winning bet, P(winning bet) = Pw
* Probability of winning bet, P(losing bet) = (1 – Pw)

By the formula of expected value, bank account total if bet accepted:

E(X) = P1 . X1 + P2. X2 + ….. + Pn. Xn

* E (X) = P(winning bet). Winning amount + P(losing bet). Losing amount

= Pw. W + (1 – Pw). L

As per our assumption, the bet is accepted if:

* Pw. W + (1 – Pw). L > B
* Pw. W + L – Pw. L > B
* Pw. W – Pw. L > B – L
* Pw. (W – L) > B – L
* **Pw > (B – L) / (W – L)**

Hence, we conclude that the bet is taken if prob. Of winning is greater that (B – L) / (W – L) :

* **Pw > (B – L) / (W – L) ..(ans)**

***Prob 2:***

Let, X be the random variable denoting the event of withdrawing a dine followed by 2 pennies from same wallet.

As per the given information, we derive probability of event E if we choose green wallet:

P(X)green wallet= (4 / 10) \* (6 / 9) \* (5 / 8) ……(by multiplication rule)

= 1 / 6

Similarly, for black wallet:

P(X)black wallet = (2 / 10) \* (8 / 9) \* (7 / 8)

= 7 / 45

For first part of the question, lets assume that the probability of choosing either wallet is equal (i.e., 0.5):  
  
 P(Green wallet) = P(Black wallet)

= P(G) = P(B) =0.5

Now, by Bayes theorem:  
  
 => P(G | X ) = P(G). P(X | G) / P(X)

= P(G). P(X | G) / [ P(G). P(X | G) + P(H). P(X | H) ]

= 0.5 \* (1/6) / [ 0.5 \* (1/6) + 0.5 \* (7/45)]

= 15 / 29 = 0.517

= > P(B | H ) = 1 - P(G | X )

= 1 – 0.517 = 0.482

***Hence***, we conclude that we are more likely to have chosen from **Green**Wallet if we get a dime followed by 2 pennies.  **…(ans)**

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Additional details for 2nd part of ques is that we are 4 times more likely to use green wallet compared to brown.

So,

P(G) = 0.8

P(B) = 0.2

So, prob. that our optimal ans in 1st part( i.e., green wallet) is wrong, acc. To Bayes’ theorem:

P(B | X) = P(H). P(X | H) / P(X)

= P(H). P(X | H) / [ P(G). P(X | G) + P(H). P(X | H) ]

= 0.2 \* (7/45) / [ 0.2 \* (7/45) + 0.8 \* (1/6) ]

= 0.189

***Hence***, we conclude that there is an **18.9% probability** that are optimal answer in prev. question was wrong.  **..(ans)**

***Prob 3:***

**1)** Code is submitted along with the assignment

**2)**  Given values are:

N1= 2000

N2 = 1000

Mean1 = 1

Mean2 =4

Var1 = 4

Var2 = 9

**Combined mean** =( N1U1 + N2U2 ) / (N1 .N2  )

= (2000 \* 1 + 1000 \* 4) / (2000 + 1000)

= 6000/3000

= **2 ..(ans)**

**Combined variance** = {N1 [var1+ (mean1 – meanc)2 ] +N2 [var2+ (mean2–meanc)2 ]}**/(**N1+N2 )

= 2000.[4+(1-2)2] + 1000.[9 + (4-2)2]/3000

= [2000.(4+1) + 1000.(9+4)] / 3000

= (10000+13000)/(3000)

= **7.667 ..(ans)**

Experimentally, the above results are successfully verified using attached code submitted along with this document. The result is as follows:  
  
