**CBA: Solutions to Practice Problem Set 6**

**Topics: Hypothesis testing**

1. True/False
2. True. *H*0: *μ*≤ 80, *H*A: μ> 80. If the test rejects *H*0, then the data would have provided enough evidence in favor of the new design in terms of higher spending amounts than the current design.
3. False. The test rejects *H*0. This cannot be a Type II error since a Type II error results from failing to reject.
4. False. The test rejects *H*0. If null hypothesis is false then we would not have committed an error. However, if null hypothesis is true then we would have committed a Type I error (the probability of which is the p-value).
5. True/False
6. False. It is possible, but not necessary. Sampling variation could produce a sample in which *p* is more than 0.4 even though *π* < 0.4.
7. False. The *p*-value is the probability of finding such or even stronger evidence than the one in hand when null hypothesis is true. While the probability that an investment service will be profitable is asking as to what is the probability that alternative is true.
8. The null hypothesis is that the therapy is not effective. That is, the test must demonstrate effectiveness of the medication. Hence, *H*0 :μ ≤ 10 mm vs*H*A : μ > 10, where *μ* is the average mm of blood pressure lowered.
9. Hotel Satisfaction Survey:
10. *H*0: *π*≥ 0.33, where *π*is the proportion of all guests who are satisfied. The alternative hypothesis is *H*A: *π*< 0.33. Recall that the alternative hypothesis is associated with action. Therefore if the null hypothesis is rejected in this case, the hotel management will take action (intervene in the local franchise).
11. A Type I error occurs if we reject *H*0 when it’s true, thereby intervening at the local franchise unnecessarily. A Type II error occurs if we fail to reject *H*0 even when it’s false, thereby missing the opportunity to intervene and correct a problem.
12. The sample proportion is 0.2. Under *H*0, the standard error is √(0.33 \* 0.67/80) ≈ 0.052;*z* = (0.2-0.33)/0.052 = -2.5. The *p*-value is P(p< 0.2; *π*≥ 0.33) =pnorm(-2.5) 0.0062.

Since p value < alpha value, we reject H0

1. Bank accounts.
2. Suppose *μ* denotes the average increase in interest profit on a savings account when offered this personalized service (4% of the average balance in the account). The cost of this service is $50. So, *H*0: *μ*≤ $50 (personalized service is not profitable) and *H*A:*μ*> 50 (personalized service is profitable).
3. A Type I error means that the bank rolled out the program, but it will not be profitable. A Type II error means that the bank should have rolled it out (rejected *H*0) but did not.
4. The average increase in the balances is $1500, earning an additional 0.04 × $1500 = $60profit. The SD of this gain is 0.04 × 3000 = $120. (Note here that one random variable (profit) has been defined as the function of a different random variable (balance) and the standard deviation is calculated accordingly).

The test statistic is *t* = (60-50)/ (120/sqrt (65)) =0.6719 with 64 degrees of freedom.

P-value=P(*xbar* > 60; *μ*≤ $50)= 1-pt(0.6719,64)≈ 0.25.

Hence we do not reject *H*0 since the *p*-value is larger than α.

Therefore, although the sample indicates that there might be an improvement in the profitability, there is not enough evidence to indicate that this improvement that the sample shows is a feature of the population and is not due to sampling variation alone.