

SHOW YOUR WORK! JUSTIFY YOUR ANSWERS!

1. Consider a regular deck of 52 cards that has been well-shuffled and put in a stack on the table.
What is the $P(\text{the top card is an Ace OR the bottom card is a King})$.
2. Ten fair 6-sided die are rolled. What is the Probability Distribution for the *total number of even numbers that would show up over the ten die*?
3. A random sample of $n=64$ is drawn from a population which has a mean of 60 and standard deviation of 9. Find the $P(\text{the sample average exceeds } 62)$?
4. A sample of size 3 is drawn at random with replacement from a box that has seven tickets with a 6 on them and three tickets with a 5 on them. Compute the exact sampling distribution for the sample median of the 3 draws.
5. A random sample of 15 people is obtained from population 1, while an independent sample of 10 people is obtained from population 2. For each person, his/her gender (g), age (a), and typical hrs of sleep (y) are obtained.
 - a. Describe a test of hypothesis to see if one can show that the Population 1 Mean typical hrs of sleep differs from that of Population 2. (Be sure to set up the null and alternative hypothesis, state any assumptions you make, present the test statistic and its distribution under H_0 , and explain how you would tell whether or not you've "shown" what you were trying to show.
 - b. Now consider the above "total sample" of $15+10 = 25$ people. First construct a (linear in the β 's) model for sample person i 's typical hrs of sleep (y_i) in terms of which population he/she came from, his/her gender, and a linear influence of his/her age. Then show how to perform a test of hypothesis to compare this model to the reduced model that does not have population in it (but does still have gender and age). Again, specific hypotheses should be stated, assumptions stated, test statistic and distribution shown, and explanation of how you would perform the test.

OVER 

6. Consider the linear relationship between phosphorous (p) and calcium (c) in soil. For random sample plots $i = 1, 2, \dots, 50$, both p and c are measured in April 2011. Show the linear regression model for predicting p from c in terms of vectors, matrices, and β 's. Show how you estimate the β 's in terms of vectors and matrices.
7. Now going back to problem 6, but consider only plot 1. It turns out that the p and c had also been measured on that plot for each of the previous 35 months. The p measure is thought to have a long-term quadratic trend over time (t) and is additionally thought to have a "seasonal" relation of being higher in the 3 summer months than in the other 9 months of the year; also the linear association between p and c is still thought to be a contributing factor to this time series model, as well as interaction between the above "seasonal" factor and the "c" variable.
 - a. State the about time series model for a particular phosphorous (p) measure at time t (can label it as: y_t), in terms of β 's, variables and "residuals", assuming first-order autocorrelation.
 - b. Discuss how you would estimate the May 2011 phosphorous level for plot 1 after you measured the May 2011 calcium level for the plot.