1. **Key Concepts:**
   (a) Counting ways: permutations, combinations and arranging with repeated objects.
   (b) Randomness
   (c) Sample space, Events.
   (d) Axioms of probability.
   (e) Independence.
   (f) Conditional probability.
   (g) Mutually exclusive.
   (h) Bayees Rule for two events.
   (i) Runs.

2. **Skills to Master:**
   (a) On what occasion does order matter and when does it not.
   (b) Developing a methodology for counting.
   (c) When are two events independent ? how to identify them.
   (d) Understanding conditional probability.
   (e) Understanding and applying the various relationships involving probability (eg. Problem 4,6 Worksheet 1)
   (f) Using Bayees formula.
   (g) Calculating probabilities from Tables. (like in Example 2.24)

3. **Practice Problems**
   (a) Suppose team A and B play a series of games and that the first team to win a total of 3 games is declared the best team. Show by means of a tree diagram the sample space. List the event specified by the statement that a total of four games are played.
   (b) If $P(A \mid B) < P(A)$ then show that $P(B \mid A) < P(B)$. Suppose two fair dice are tossed. What is the probability that the sum equals 10 given that it exceeds 8 ?
   (c) Two sections of a probability course are being taught. From what she has heard about the two instructors, a student estimates her chances of passing the course are 0.85 if she gets instructor A and 0.60 if she gets instructor B. Suppose the probability that the registrar will assign her to instructor A is 0.4. If she passed the course, then what is the probability that she had instructor A ? *Ans: 0.48*

4. An urn Contains b black balls and r red balls. One of the balls is drawn at random, but when it is put back in the urn c additional balls of the same color are put in with it. Now suppose that we draw another ball. Show that the probability that the first ball drawn was black given that the second ball drawn was red is $\frac{b}{b+r+c}$.

[1] **Office hours:** Monday:2:00-3:00pm, Tuesday:10:30-11:30, 3:30-4:30 pm

1. **Quiz 3:** on Wednesday 27th. Syllabus: 3.1,3.2,3.3,3.4
2. **Independence:**
   (a) When are two events A and B independent ?
   (b) Suppose X_1 and X_2 are two discrete random variables on the same sample space S. How would you define independence among random variables ? i.e When would you say that X_1 and X_2 are independent ?
3. **Independent Random variables:** Suppose X_1 records the outcome of rolling die A. Suppose X_1 records the outcome of rolling another independent die B.
   (a) Show that X_1 and X_2 are independent.
   (b) Let $X = X_1 + X_2$. Show that $E(X) = E(X_1) + E(X_2)$ and $V(X) = V(X_1) + V(X_2)$.
4. **Using Independence :** It is known that if $X_1, X_2, \ldots, X_n$ are independent random variables and if $X = X_1 + X_2 + X_3 + \ldots + X_n$ then

$$\begin{aligned} E(X) &= E(\textstyle\sum_{i=1}^n X_i) = \sum_{i=1}^n E(X_i) \\ V(X) &= V(\textstyle\sum_{i=1}^n X_i) = \sum_{i=1}^n V(X_i). \end{aligned}$$

   Use the above idea to calculate $E(X)$ and $V(X)$ when:
   (a) $X \sim$ Binomial (n, p)
   (b) $X \sim$ Negative Binomial(r, p)

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