MTH 23.5 LECTURE NOTES (Ojakian)

Topic 10: Basic Probability, Sample Space, and Events

OUTLINE

References (**Algebra Book**: None; **Statistics Book**: 3.1)

1. Basic probability
2. Sample Space and Events

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1. Openning Example
   (a) These days, what are the biggest dangers for people living in the USA? (measure this by the chance that it kills you ...)
   (b) See Death statistics.
   (c) Return to example after some terminology.
2. Introducing Probability
   (a) There are 7 videos. Watch videos 1 and 2 now (wait on the rest of the videos).
   (b) Assigns real number between 0 and 1 to some outcome.

   PROBLEM 1. *Convert 0 and 1 to percents.*

   PROBLEM 2. *If the chance of something happening is* 25%*, write this as a decimal and as a fraction.*

   (c) Sample Space (not same as "sample" from population): Set of all outcomes.

   PROBLEM 3. *Find the sample space in each of the following cases: 1) Flip one coin, 2) Flip two coins, 3) Flip three coins.*

   (d) Equal liklihood assumption.

   PROBLEM 4. *How would you assign probabilities in the above cases of coins? What about rolling a 6-sided die. Calculate the probabilities as percents also.*

   (e) Sums to 1
   (f) Event - Subset of the sample space
   Represent as drawing: Sample space as a big rectangle and event inside it.

   PROBLEM 5. *If you roll a die, what is the probability of an odd result? What is the probability of a result larger than 2?*
   (express the event in the sample space, then find the probability)

   (g) Fundamental Idea for Equal Liklihood:

$$P(E) = \frac{\text{Number of outcomes in the event}}{\text{Number of outcomes in the sample space}}$$

   i.

PROBLEM 6. *You have a bag with marbles: 1 red, 2 white, and 3 blue, and you will choose one marble.*
Find the sample space. Find the probability of each event: Choosing red, choosing white, choosing blue. Choosing white or blue.
Also, represent it as a histogram, and the probabilities as a relative frequency histogram

PROBLEM 7. *(Similar problem about inventors)*
Section 5.1 from MY Stats Book 5th Edition (p. 165): Exercise 11.
Also, represent it as a histogram, and the probabilities as a relative frequency histogram

ii. **Return to death statistics.**
Think of sample space = all US residents. Then randomly choose resident. What is the probability that that person dies of X?

3. Basic problems with video solutions

PROBLEM 8. *Section 5.1 from MY Stats Book 5th Edition (p. 164): Exercise 3*

PROBLEM 9. *Section 5.1 from MY Stats Book 5th Edition (p. 165): Exercise 9*

WATCH: Video 3 for solutions

4. Harder Problems with Dice

WATCH: Video 4.

(a) Example of a more complicated sample space: TWO 6-sided dice are rolled.
The sample space consists of the 36 pairs of possible die rolls. Draw it!

(b)

PROBLEM 10. *Suppose 2 dice are rolled. What is the probability that the sum is 6? The probability that the sum is 4?*
What sum do you think has the highest probability? (hint: as a craps player ...)
WATCH: Video 5 for solutions.

5. Harder Problems with Playing Cards

WATCH: Video 6.

(a) Example of a more complicated sample space: 52 Standard Playing Cards

i. The sample space consists of the 52 playing cards, broken into categories as discussed in the video.

ii.

PROBLEM 11. *If you draw a single card from the deck, what is the probability of drawing a King?*

PROBLEM 12. *If you draw a single card from the deck, what is the probability of drawing a red Ace or a black Face Card?*

WATCH: Video 7 for solutions.