MTH 23.5 LECTURE NOTES (Ojakian)

Topic 13: Probability- Conditional Probability

OUTLINE

References (**Algebra Book**: None; **Statistics Book**: 3.2, 3.3, 3.4)

1. Conditional Probability
2. Contigency Tables

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1. Openning Example On Smoking
   (a) P(Dying of esophageal cancer | Live in USA) = 0.00004
   (b) P(Dying of esophageal cancer | Live in Central Asia) = 0.00140
   (c) P(Dying of lung cancer | Male and smoker) is 22 times larger than: P(Dying of lung cancer).
   (d) In general: $P(A|B)$ = Probability of event A happening given that event B happens.
2. Meaning of Conditional Probability
   To find $P(A|B)$, limit yourself to the outcomes in B and find the percent of those that are also in A.

   PROBLEM 1. *Suppose you flip a fair coin three times.*

   (a) What is the probability of 3 heads?
   (b) What is the probability of 3 heads given that at least two flips are heads?
   (c) Calculate P(Exactly two heads | At least one tail).
3. Contingency tables and Conditional Probability
   $P(A|B)$: The probability of event A when restricted to remaining inside event B.
   (a) Section 3.4 - Example 3.20
   (b) Students: Section 3.4 - Try It! - 3.20
   (c) Section 3.4 - Example 3.22 (With probabilities instead of quantities)
   (d) Can turn one of above frequency examples into probabilities.
   (e) False Positive, False Neg Example. Brase and Brase (8th ed), section 5.2: 28, 29
4. Conditional Probability: Mathematical Formula

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$$

   PROBLEM 2. *Do some of the above problems, using the formula.*
5. Recall Independence
   Why the definition makes sense from point of view of conditional probability
   If B has no effect on A, then $P(A|B) = P(A)$. And then what ... ?

6. Problems

Some combine with previous probability topics

(a) Practice Problems Section 3.3: 44 - 47.

(b) Chap 3 Homework: 85, 86, 100

(c) Brase and Brase (8th Ed) Section 5.2: 13, 14 (translate to symbols)