6/08/20

Agenda for Math 5710 ♬ Meeting #26 ☻☺ 7/29/20 (8:00 a.m. – 9:10 a.m.)

1. Hello:

Brigham City:	Adam Blakeslee	Ryan Johnson	Tyson Mortensen	
Logan:	David Allen	Natalie Anderson	Kameron Baird	Stephen Brezinski
	Zachary Ellis	Adam Flanders	Brock Francom	Xiang Gao
	Ryan Goodman	Janette Goodridge	Hadley Hamar	Phillip Leifer
	Brittney Miller	Jonathan Mousley	Erika Mueller	Shelby Simpson
	Steven Summers	Matthew White	Zhang Xiaomeng	

2. Note the syllabus' activity list for today:

26: W/7/29	1. Focus on experiments that involve random sampling from a population. 2. Discover, comprehend, and outline a proof for the principle of large numbers theorem. 2. Take advantage of Quiz 26.

3. Briefly raise issues and questions prompted by the following homework assignment:

   A. Study our notes from Meeting #25.

   B. Comprehend the sample responses to Quiz 25's prompts

   C. From the Video Page of *Canvas*, view with comprehension the video named "law of large numbers."

4. Walk through a sample of experiments that employ sampling from a population:

   A. Frankie & Johnny conducted a study involving the engineering firms in the U.S. that reported the 300 highest total revenues between 2009 and 2018 inclusive. These 300 firms employed 46800 engineers in the 2018 fiscal year. The study was designed to assess the opinions of the engineers regarding the variety of useful on-the-job competencies they developed in their college/university undergraduate programs. Frankie and Johnny gathered relevant data by administering questionnaires to all of the engineers from a random sample of 50 of the 300 engineering firms.

   B. Vanessa conducted a study involving the engineering firms in the U.S. that reported the 300 highest total revenues between 2009 and 2018 inclusive. These 300 firms employed 46800 engineers in the 2018 fiscal year. The study was designed to assess the opinions of the engineers regarding the variety of useful on-the-job competencies they developed in their college/university undergraduate programs. Vanessa gathered relevant data by administering questionnaires to 500 engineers who were randomly sampled from the population of 46800 engineers employed by those 300 firms during 2018.

Sidebar Peek at two problems from Meeting #15's homework:

ii. Assume that in a two-child family, all sex distributions are equally probable. An experiment is conducted in which a ***family*** is randomly selected from { families that have exactly two children }; the selected family has at least one girl. What is the probability that the second child is also a girl?

Sample computation:

Let A be the event that the selected family has two girls $\wedge$ let B be the event that the family has a girl. For this family with exactly two children, let $\Omega =$
$\{ (f, s) : f =$ the sex of the first born $\wedge\ s$ is the sex of the second born $\} =$
$\{ (g, g), (g, b), (b, g), (b, b) \}$. We need to compute $p(A|B)$:

$$p(A|B) = \frac{p(A \cap B)}{p(B)} = \frac{0.25}{0.75} = \frac{1}{3}$$

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iii. Assume that in a two-child family, all sex distributions are equally probable. An experiment is conducted in which a ***child*** is randomly selected from { families that have exactly two children } and that particular child is a girl. What is the probability that the second child is also a girl?

Sample computation:

Let B be the event that the randomly selected child is a girl $\wedge$ let A be the event that her sibling is also a girl. We need to compute $p(A|B)$:

$$p(A|B) = \frac{p(A \cap B)}{p(B)} = \frac{0.25}{0.50} = \frac{1}{2}$$

C. Ferguson conducted a study to gage the reading levels of the 144 history books in the Albion Village Library. Although he would have liked to test all of the books using the *Fountus-Pinnell Guided Reading* test, due to measurement usability considerations he only tested a sample of 12. He selects the 12 books from alphabetical listing of the titles by picking the 12^{th}, 24^{th}, 36^{th}, ..., 144^{th}.

D. T.J. conducted a study to gage the reading levels of the 144 history books in the Albion Village Library. Although she would have liked to test all of the books using the *Fountus-Pinnell Guided Reading* test, due to measurement usability considerations she only tested a sample of 12. She selects the 12 books from an alphabetical listing of the titles via the following process: (1) She takes 12 equal size discs and writes a different numeral on each labeled "1," "2," "3," ..., "12." She then places the 12 discs in a shoe box and closes it. The box is vigorously shaken and rolled over several times. With her eyes closed, she retrieves one disk from the box. The disk displaying "8" is blindly selected. From the alphabetized listing she deliberately selects the 8^{th}, 20^{th}, 32^{nd}, ..., 140^{th} titles.

Sidebar reference:

Remind ourselves of our definition for random outcome:

032A. Definition for *random outcome*: : The outcomes of Ω are *random* $\Leftrightarrow$
$(p \in \{\text{ probability measures on } \Omega\} \wedge (p(\{x\}) = p(\{y\}) \ \forall \ x, y \in \Omega))$

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5. For comprehension purposes, reflect on the Principle of Large Numbers, closely walk through Theorem 14, and develop a plan for proving it:

048. Theorem 14 (the Principle of Large Numbers):

$((n \in \mathbb{N} \wedge X_1, X_2, X_3, ..., X_n \in \{$ independent trials process with continuous function $p\} \wedge (\mu \in \mathbb{R} \ni \mu$ is the expected value of $X_i \ \forall i \in \{1, 2, 3, ..., n\}) \wedge (\sigma \in [0, \infty) \ni \sigma^2$ is the expected variance of $X_i \ \forall i \in \{1, 2, 3, ..., n\})) \Rightarrow$

$$\lim_{n\to\infty}\left(p\left(\left|\frac{\sum_{i=1}^{n} X_i}{n} - \mu\right|\right)\right) = 0$$

6. Take advantage of Quiz 26.

7. Complete the following assignments prior to Meeting #27:

   A. Study our notes from Meeting #26

   B. Study the sample responses to Quiz #26's prompts that are posted in the indicated page section of *Canvas*.

   C. Deeply comprehend Theorem 14 listed as Entry 048 in our *Glossary* and reflect on how we might prove it.

8. And from W.S. Anglin (1934–1992):

   Mathematics is not a careful march down a well-cleared highway, but a journey into a strange wilderness, where the explorers often get lost. Rigor should be a signal to the historians that the maps have been made, and the real explorers have gone elsewhere.