

Homework 6 (Graded)

 Published

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Due Friday, 7/19, by the end of Sheridan's office hours at 4pm in CMU B-023

ASV exercises 4.54 and 5.40 (and state a general theorem relating $M(a)$ to $M(b)$ for positive $a < b$ --you do not need to prove it. Hint: search for "Jensen's inequality").

S6.1: consider the example from class, in which we assume there are 10,000 people of child-bearing age in Puyallup, that they become pregnant independently each with some probability p . Suppose that 9 months later we will check the birth records for these 10,000 people. Find an upper bound for the probability that the observed percentage of people who gave birth differs from p by more than 0.02 (2 percentage points). Then, find the birth rate that would yield the highest probability for the observed number of births under the binomial distribution with $n = 10,000$. This birth rate q should be a function of the observed number of births.

S6.2: construct the following examples (must be nontrivially different than those discussed in class):

- A sequence of random variables that converges in distribution to another random variable, but not in probability.
- A sequence of random variables that converges in probability to another random variable, and prove it.

S6.3: Let $X \sim Unif(0, 2\pi)$, $Y = \sin(X)$. Find the pdf of Y .

S6.4: Suppose you are using a programming language that permits you to define arbitrary functions, but as for randomness can only generate $Unif(0,1)$ random variables. You must generate samples from the following random process: Sheridan flips a fair coin. If heads, he picks an angle uniformly at random from 0 to 45 degrees, shoots a harpoon at a 100m high wall from 100m away (no gravity), and measures how high on the wall the harpoon landed. If tails, he picks an X and a Y each uniformly at random from -1 to 1, plots the point, and determines which quadrant (1-4) of the Cartesian plane it lands in. How do you generate such a sample? You may use "pseudocode," words, and mathematics to describe the process, but your final explanation need only be 1) fairly short and 2) correct.

Points 15

Submitting on paper

Due	For	Available from	Until
-	Everyone	-	-