

Assignment 2

Due Date: Monday, October 8

Topics: Probability, Sampling Distributions, and Hypothesis Testing (Agresti and Finlay, chapter 4 and chapter 6, sections 1 through 2)

1. In a statewide lottery, one can buy a ticket for \$1. With probability 0.00000001, one wins ten million dollars (\$10,000,000), and with probability 0.99999999 one wins nothing (\$0).
 - (a) Let X denote the winnings from buying one ticket. Construct the probability distribution for X . Show that the mean of the distribution equals 0.10, corresponding to an expected value of 10 cents for the dollar paid.
 - (b) The profit Y from buying a single \$1 ticket equals the winning X from playing the lottery minus the dollar paid for the ticket; that is, $Y = X - 1$. Construct the probability distribution for Y , and find its mean. Interpret.

2. Suppose that a discrete random variable X takes on the value -1 with probability 0.3, the value 3 with probability 0.5 and the value 4 with probability 0.2.
 - (a) Construct the probability distribution of this random variable.
 - (b) What is the expected value of the random variable?
 - (c) What are the variance and standard deviation of the random variable?

3. Suppose that the random variable X represents household income measured in thousands of dollars with $\mu = E[X] = 61$ and $\sigma = \sqrt{\text{Var}(X)} = 12$. Suppose that Y represents household income measured in dollars. What are $E[Y]$, $\text{Var}(Y)$, and the standard deviation of Y ?
4. Suppose that X is a normal random variable with mean $\mu = 1$ and standard deviation $\sigma = 2$.
- (a) What is the probability that X falls between 0 and 4?
- (b) What is the probability that X is less than 3?
5. Suppose that the population average SAT scores of U of R students is 1220. Suppose that there are 31 students registered for PSC 200, and these students have a sample mean SAT score of 1250 with a standard deviation of 90. Test the null hypothesis that the average PSC 200 student has an SAT score of 1220 against the alternative that the average is different from 1220, using the $\alpha = 0.05$ significance level. Would your answer change if you used a 10% significance level?
6. A 95% confidence interval for the mean duration of cabinet governments in Italy is computed to be $[3.25, 3.78]$. For which of the following values of μ_0 can the null hypothesis $H_0 : \mu = \mu_0$ be rejected at the 5% level (assume a two-sided alternative).
- (a) 3.2
- (b) 3.4

(c) 3.6

(d) 3.8

(e) 4.0