

**Directions**

Scan and upload your *handwritten* solutions to eLearning by the end of the day on **Monday, April 17**. Calculator functions are permitted. Show all steps of hypothesis testing for problems 3 and 4: Include hypotheses, rejection region, test statistic,  $p$ -value, and conclusion.

**Problem 1 (2 points)**

Consider the following hypotheses from the classical court of law example.

$$H_0 : \text{not guilty}$$

$$H_a : \text{guilty}$$

Two errors that can be made by the jury are (1) letting a truly guilty person go free and (2) letting a truly innocent person go to jail. Which is a Type I error? Which is a Type II error? Justify your answers by applying the error definitions.

**Problem 2 (2 points)**

Suppose the null hypothesis for a population mean is  $H_0 : \mu = 14$ . Suppose data is collected from a sample of size  $n = 25$  and  $\sigma$  is unknown.

- (a) A researcher believes the mean is higher. The computed test statistic is 3.024. Compute the  $p$ -value of the test. At  $\alpha = 0.05$ , what do you conclude?
- (b) Another researcher believes the mean is not 14. The computed test statistic is  $-1.275$ . Compute the  $p$ -value of the test. At  $\alpha = 0.10$ , what do you conclude?

**Problem 3 (3 points)**

According to the American Time Use Survey, the typical American spends 154.8 minutes per day watching television. A survey of 50 internet users results in a mean time watching television per day of 148.7 minutes with a sample standard deviation of 46.5 minutes. The researcher wants to know if the true mean differs from 154.8 minutes. At  $\alpha = 0.04$ , conduct an appropriate hypothesis test to answer the researcher's inquiry.

**Problem 4 (3 points)**

An account on server A is more expensive than an account on server B. However, server A is faster. To see if it is optimal to go with the faster but more expensive server, a manager needs to know if server A is significantly faster than server B. A certain computer algorithm is executed  $n_A = 30$  times on server A and  $n_B = 20$  times on server B with sample mean and standard deviation of the performance speed of each server (in minutes):

Server A	Server B
$\bar{x}_A = 6.7$ minutes	$\bar{x}_B = 7.5$ minutes
$s_A = 0.6$ minutes	$s_B = 1.2$ minutes

At  $\alpha = 0.05$ , determine if server A is faster than server B using an appropriate significance test. Assume  $\sigma_A^2 \neq \sigma_B^2$ .