

**Math 107. Review for the third midterm**  
**Solutions to the problems which are not solved in the book.**

**10.14** (a)  $\alpha = 0.05$

1. **Hypotheses:**  $H_0 : \mu = 15.0$ ;  $H_A : \mu > 15.0$ .

2. **Level of significance:**  $\alpha = 0.05$ .

3. **Criterion:**

Reject  $H_0$  if  $\frac{\bar{x}-15.0}{s/\sqrt{n}} > z_\alpha = 1.645$ , otherwise reserve judgment.

4. **Calculations:** We have  $\bar{x} = 15.4$ ,  $s = 2.4$ ,  $n = 150$ , and

$$\frac{15.4 - 15.0}{2.4/\sqrt{150}} \sim 2.04 > 1.645.$$

5. **Decision:** Reject the null hypothesis.

(b)  $\alpha = 0.01$

1. **Hypotheses:**  $H_0 : \mu = 15.0$ ;  $H_A : \mu > 15.0$ .

2. **Level of significance:**  $\alpha = 0.01$ .

3. **Criterion:**

Reject  $H_0$  if  $\frac{\bar{x}-15.0}{s/\sqrt{n}} > z_\alpha = 2.326$ , otherwise reserve judgment.

4. **Calculations:** We have  $\bar{x} = 15.4$ ,  $s = 2.4$ ,  $n = 150$ , and

$$\frac{15.4 - 15.0}{2.4/\sqrt{150}} \sim 2.04 < 2.326$$

5. **Decision:** Reserve judgment.

**R.143**

1. **Hypotheses:**  $H_0 : \mu = 81.7$ ;  $H_A : \mu < 81.7$ .

2. **Level of significance:**  $\alpha = 0.05$ .

3. **Criterion:**

Reject  $H_0$  if  $\frac{\bar{x}-81.7}{s/\sqrt{n}} < -z_\alpha = -1.645$ , otherwise reserve judgment.

4. **Calculations:** We have  $\bar{x} = 79.6$ ,  $s = 8.5$ ,  $n = 100$ , and

$$\frac{79.6 - 81.7}{8.5/\sqrt{100}} \sim -2.47 < -1.645.$$

5. **Decision:** Reject the null hypothesis.

The  $p$ -value for the problem is  $0.5000 - 0.4932 = 0.0068$ .

**R.145**

1. **Hypotheses:**  $H_0 : \mu_1 = \mu_2$ ;  $H_A : \mu_1 > \mu_2$ .
2. **Level of significance:**  $\alpha = 0.01$ .
3. **Criterion:**

Reject  $H_0$  if  $\frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}} > z_\alpha = 2.326$ .

Otherwise reserve judgment.

4. **Calculations:** We have

$$\frac{8.6 - 8.3}{\sqrt{\frac{(0.75)^2}{70} + \frac{(0.80)^2}{50}}} \sim 2.08 < 2.326.$$

5. **Decision:** Reserve judgment.

**R.146**

1. **Hypotheses:**  $H_0 : \mu_1 = \mu_2$ ;  $H_A : \mu_1 > \mu_2$ .
2. **Level of significance:**  $\alpha = 0.01$ .
3. **Criterion:**

Reject  $H_0$  if  $\frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}} > z_\alpha = 2.326$ .

Otherwise reserve judgment.

4. **Calculations:** We have

$$\frac{15.0 - 14.5}{\sqrt{\frac{(1.6)^2}{48} + \frac{(1.4)^2}{48}}} \sim 1.63 < 2.326.$$

5. **Decision:** Reserve judgment.

**R.147**

1. **Hypotheses:**  $H_0 : \mu = 10.0$ ;  $H_A : \mu > 10.0$ .
2. **Level of significance:**  $\alpha = 0.05$ .
3. **Criterion:**

For each patient we have to compute the difference between the level of blood sugar before and after taking medication, i.e. by how many points the blood sugar dropped for this patient. Then, we compute  $\bar{x}$  and  $s$  for this sample. We reject  $H_0$  if  $\frac{\bar{x} - 10}{s/\sqrt{n}} > t_\alpha = 1.796$  ( $12 - 1 = 11$  degrees of freedom). Otherwise we reserve judgment.

4. **Calculations:** From the sample we find  $\bar{x} = 13.25$  and  $s \sim 5.96$ . Thus

$$\frac{13.25 - 10}{5.96/\sqrt{12}} \sim 1.89 > 1.79.$$

5. **Decision:** Reject the null hypothesis.

### 11.10

1. **Hypotheses:**  $H_0 : p = 0.5$ ;  $H_A : p < 0.5$ .

2. **Level of significance:**  $\alpha = 0.01$ .

3. **Criterion:**

Reject  $H_0$  if  $\frac{x-0.5n}{\sqrt{n(0.5)(1-0.5)}} < -z_\alpha = -2.326$ , otherwise reserve judgment.

4. **Calculations:** We have  $x = 90$ ,  $n = 200$ , and

$$\frac{90 - 0.5 \cdot 200}{\sqrt{200 \cdot 0.5 \cdot 0.5}} \sim -1.41 > -2.326.$$

5. **Decision:** Reserve judgment.