Midterm Exam Answers

1. a, b
2. d
3. c
4. b, d
5. e

6. (a) $\widehat{\text{var}(\hat{p}_m)} = \dfrac{0.49 \times 0.51}{600} = 0.00042$

$\widehat{\text{var}(\hat{p}_w)} = \dfrac{0.43 \times 0.57}{500} = 0.00049$

(b) i. $H_0 : p_m = 0.5$ vs. $H_1 : p_m < 0.5$

ii. $t\text{-stat} = \dfrac{0.49 - 0.5}{\sqrt{0.00042}} = \dfrac{0.49 - 0.5}{0.0204} = -0.49$

iii. $p\text{-value} = \Phi(-0.49) = 0.3121$

iv. We cannot reject H_0 at the 10% significance level because p-value > 0.1.

(c) i. $\hat{p}_m - \hat{p}_w = 0.06$

ii. $SE(\hat{p}_m - \hat{p}_w) = \sqrt{\widehat{\text{var}(\hat{p}_m - \hat{p}_w)}} = \sqrt{\widehat{\text{var}(\hat{p}_m)} + \widehat{\text{var}(\hat{p}_w)}} = \sqrt{0.00042 + 0.00049} = 0.0301$

iii. 95% CI for $p_m - p_w = (\hat{p}_m - \hat{p}_w) \pm 1.96 SE(\hat{p}_m - \hat{p}_w) = [0.0010, 0.1190]$

iv. We can reject H_0 at the 5% significance level because the 95% CI does not include 0.

7. (a) $\hat{\beta}_0 = 772.426$, $\hat{\beta}_1 = 11.746$

$SE(\hat{\beta}_0) = 48.943$, $SE(\hat{\beta}_1) = 5.863$

CEOs with zero years of tenure earn 772,426 USD per year on average. A CEO with one more year of tenure earns more by 11,746 USD per year.

Both β_0 and β_1 are statistically significantly different from zero at the 5% significance level because the p-values for the two-sided test are less than 0.05: less than 2×10^{-16} for β_0 and 0.04667 for β_1.

(b) $\overline{salary} = \hat{\beta}_0 + \hat{\beta}_1 \overline{ceoten} = 772.426 + 11.746 \times 7.955 = 865.8654$ Thus, the average annual salary is 865,865.4 USD.

(c) $\widehat{\text{var}(\hat{\beta}_0)} = 2395.4089$, $\widehat{\text{var}(\hat{\beta}_1)} = 34.37488$

(d) $\hat{\beta}_0 = 772.426 \times 1000/12 = 64,368.8$ USD per month

$\hat{\beta}_1 = 11.746 \times 1000/12 = 978.8$ USD per month/year

$SE(\hat{\beta}_0) = 48.943 \times 1000/12 = 4,078.6$ USD per month

$SE(\hat{\beta}_1) = 5.863 \times 1000/12 = 488.6$ USD per month/year

$R^2 = 0.02043$ doesn't change.

$SER = 583.2 \times 1000/12 = 48,600$ USD per month