Quiz 12 – Solutions

-15 for incorrect test

Question 1:

dose A: Viagara dose B: Placebo

$\text{sample \%}_A = \frac{117}{734} = 15.9\%$ $\text{sample \%}_B = \frac{29}{725} = 4.0\%$

1) null: no difference in percentage of men that experience headaches, i.e., (2)

$\text{dose A\%} - \text{dose B\%} = 0\%$

alternative: higher percentage of men that take Viagara experience headaches, i.e., (2)

$\text{dose A\%} - \text{dose B\%} > 0\%$

2) 2-sample z-test:

$\text{SD dose}_A = \sqrt{\frac{117}{734} \cdot \frac{617}{734}} = 0.366$ (1) $\text{SD dose}_B = \sqrt{\frac{29}{725} \cdot \frac{696}{725}} = 0.196$ (1)

$\text{SE sam}_A = \sqrt{734} \cdot 0.366 = 9.92$ (1) $\text{SE}_{\text{sam}B} = \sqrt{725} \cdot 0.196 = 5.28$ (1)

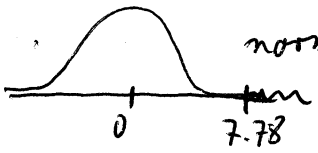
$\text{SE\%}_A = \frac{9.92}{734} \cdot 100\% = 1.35\%$ (1) $\text{SE\%}_B = \frac{5.28}{725} \cdot 100\% = 0.73\%$ (1)

$\text{SE diff\%} = \sqrt{1.35\%^2 + 0.73\%^2} = 1.53\%$ (2)

observed % (difference) $= 15.9\% - 4\% = 11.9\%$ (1)

expected % (difference) $= 0\%$

$z = \frac{11.9\% - 0\%}{1.53\%} = 7.78$ (2)

3) 

normal curve: 7.78 off the table, i.e., area above 7.78 is about 0%

$\rightsquigarrow$ p-value: about 0% (2)

4) Conclusion:

- reject the null (p-value < 1%) (1)
- result is highly statistically significant (1)
- there is high evidence that a higher percentage of men that take Viagara experience headaches than men not taking Viagara (1)

Question 2: -8 for incorrect test

1) null: mixe is Ok, i.e., peanuts : hazelnuts : cashews : pecans = 5 : 2 : 2 : 1 (1)

alternative: mixe is not Ok, i.e., peanuts : hazelnuts : cashews : pecans ≠ 5 : 2 : 2 : 1 (1)

2) χ^2-test:

Nut Type	obs	esep	$\frac{(obs-esp)^2}{esp}$
Peanuts	269	250	$\frac{(269-250)^2}{250} = 1.44$
Hazelnuts	112	100	$\frac{(112-100)^2}{100} = 1.44$
Cashews	74	100	$\frac{(74-100)^2}{100} = 6.76$
Pecans	45	50	$\frac{(45-50)^2}{50} = 0.50$
	500	500	

(2)

$\chi^2 = 1.44 + 1.44 + 6.76 + 0.50 = 10.14$ (1)

$df = 4 - 1 = 3$ (1)

3) $\chi^2 = 10.14$ is between 7.82 and 11.34
(7.82 ↓ 5%, 11.34 ↓ 1%)

⇝ P-value is somewhere between 1% and 5% (2)

4) Conclusion:

- reject the null (P-value < 5%) (1/2)
- results is statistically significant (1/2)
- there is some evidence that the mixe is not Ok, i.e., the ratio of peanuts : hazelnuts : cashews : pecans is not 5 : 2 : 2 : 1 (1)

Question 3: -8 for incorrect test

1) null: high school seniors require usual amount of time, i.e., love avg = 35 min (1)

alternative: high school seniors require different amount of time, i.e, love avg ≠ 35 min (1)

2) t-test:
- sample size = 20 (< 30)
- SD of love unknown (only SD of sample is known)
- times to complete quiz follow normal curve

two-tailed test since we ask for ≠ 35 min

observed (avg) = 33.1 min

expected (avg) = 35 min

$SD_t = 4.3 \cdot \sqrt{\frac{20}{20-1}} = 4.4$ (1)

$SE_{sum} = \sqrt{20} \cdot 4.4 = 19.7$ (1)

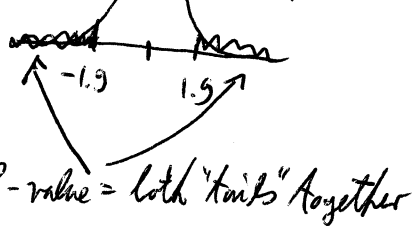
$SE_{avg} = \frac{19.7}{20} = 0.99 \approx 1.0$ (1)

$t = \frac{33.1 - 35}{1.0} = -1.9$ (1)

3) Note that the t-curve is symmetric around 0, so we have to look up 1.9 (instead of -1.9) in the table for the t-curve with 19 degrees of freedom:

t = 1.9 is between 1.73 and 2.09 (1)

5% 2.5%



⇝ P-value: both "tails" together, i.e, between 5% and 10% (1)

4) Conclusion:
- do not reject the null (P-value > 5%) (1)
- there is not enough evidence to say that high school seniors require a time different from 35 min (1)

Note: A one-tailed test would reject the null!