MATH1001 Worksheet III-4 (solution)

9.2.7

In populations of the snail *Cepaea*, the shells of some individuals have dark bands, while other individuals have unbanded shells. Suppose that a biologist is planning a study to estimate the percentage of banded individuals in a certain natural population, and that she wants to estimate the percentage—which she anticipates will be in the neighborhood of 60%—with a standard error not to exceed 4 percentage points. How many snails should she plan to collect?

The required n must satisfy the inequality

$$\sqrt{\frac{(Guessed\ \tilde{p})(1-Guessed\ \tilde{p})}{n+4}} \leq \text{Desired SE}$$

or

$$\sqrt{\frac{0.6(0.4)}{n+4}} \leq 0.04.$$

It follows that $\frac{\sqrt{0.6(0.4)}}{0.04} \leq \sqrt{n+4}$

Or $\frac{(0.6)(0.4)}{0.04^2} \leq n+4$ or $150 \leq n+4$, so $n \geq 146$.

9.4.10

Scientists have used Mongolian gerbils when conducting neurological research. A certain breed of these gerbils were crossed and gave progeny of the following colors

Color	Black	Brown	White
Number of progeny	40	59	42

(a) What is the value of the chi-square test statistic for investigating whether these data are consistent with the 1:2:1 ratio predicted by a certain genetic model?

(b) The P-value for the chi-square test is 0.149. If α = 0.05, what is your conclusion regarding H_0?

(a) $\chi^2_s = 3.81$

(b) We do not reject H_0. There is little or no evidence (P=0.149) to conclude that the model is incorrect; the data are consistent with the 1:2:1 ratio predicted by the model.

10.2.7

Phenytoin is a standard anticonvulsant drug that unfortunately has many toxic side effects. A study was undertaken to compare phenytoin with valproate, another drug in the treatment of epilepsy. Patients were randomly allocated to receive either phenytoin or valproate for 12 months. Of 20 patients receiving valproate, 6 were free of seizures for the 12 months, while 6 of 17 patients receiving phenytoin were seizure free.

Consider a chi-square test to compare the seizure-free response rates for the two drugs using a nondirectional alternative.

(i) State the null and alternative hypotheses in symbols.

(ii) What is the value of the test statistic?

(iii) The P-value for the test is 0.73. If $\alpha = 0.10$, what is your conclusion regarding the hypotheses in (ii)?

(i) H_0: $p_1=p_2$; H_A: $p_1 \neq p_2$.

(ii) $\chi^2_s = 0.1175$.

(iii) We retain H_0. There is insufficient evidence (P=0.73) to conclude that the two drugs are not equally effective.

10.7.6

In an experiment to treat patients with "generalized anxiety disorder," the drug hydroxyzine was given to 71 patients, and 30 of them improved. A group of 70 patients were given a placebo, and 20 of them improved. Let p 1 and p 2 represent the probabilities of improvement using hydroxyzine and the placebo, respectively. Construct a 95% confidence interval for $(p_1 - p_2)$.

$\tilde{p}_1 = 31/73 = 0.4247$, $\tilde{p}_2 = 21/72 = 0.2917$.

$$SE_{(\tilde{P}_1 - \tilde{P}_2)} = \sqrt{\frac{(0.4247)(0.5753)}{73} + \frac{(0.2917)(0.7083)}{72}} = 0.0788.$$

$(0.4247 - 0.2917) \pm (1.96)(0.0788)$

$(-0.021, 0.287)$ or $-0.021 < p_1 - p_2 < 0.287$.