

SM-1402: Exercise 4 (Analysing qualitative data)

- Let X be a binomial random variable with $p = 0.1$ and $n = 10$. Calculate the following probabilities. You may refer to the binomial tables or calculate “by hand”.
 - $\Pr(X \leq 2)$
 - $\Pr(X > 8)$
 - $\Pr(X = 4)$
 - $\Pr(5 \leq X \leq 7)$
- Because not all airline passengers show up for their reserved seat, an airline sells 125 tickets for a flight that holds only 120 passengers. The probability that a passenger does not show up is 0.10, and the passengers behave independently.
 - What is the probability that every passenger who shows up can take the flight?
 - What is the probability that the flight departs with empty seats?
- Newborn babies are more likely to be boys than girls. A random sample found 13,173 boys were born among 25,468 newborn children. The sample proportion of boys was 0.5172. Is this sample evidence that the birth of boys is more common than the birth of girls in the entire population? Construct a 95% confidence interval for the proportion of boys born.
- Let $\alpha \in (0, 1)$ be the significance level of a test. Consider the two points $b = \chi_k^2(\alpha/2)$ and $a = \chi_k^2(1 - \alpha/2)$, i.e. the top and bottom $\alpha/2 \times 100\%$ point of the χ_k^2 distribution. To be clear, $\Pr(Y > \chi_k^2(\alpha/2)) = \alpha/2$ when $Y \sim \chi_k^2$. Find the values of a and b for the following values of α and k :
 - $\alpha = 0.10, k = 8$
 - $\alpha = 0.05, k = 29$
 - $\alpha = 0.01, k = 3$
- Was there a gender survivability bias on board the Titanic? Of the 891 persons aboard, 577 were male and 314 were female. Of the 577 males, 109 survived; while 233 females survived. Construct a 2×2 contingency table and test the hypothesis that “males and females have a similar probability of surviving the Titanic disaster”.
- Consider responses to the cardio workout and physical fitness questionnaire (from the lectures).

Cardiovascular workouts?	Physical fitness			Total
	Bad	Medium	Good	
No	6	6	3	15
Yes	3	6	6	15
Total	9	12	9	30

- State the hypothesis to be tested with this 2×3 table.
- Test, at the 5% significance level, the hypothesis stated in part (a).