Homework Set 3 Solutions

MAT 203, Elementary Statistics, Term IV
Coker College
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Homework Policy: The point of homework is to learn by doing. I have no problem if you work in groups, use the internet or use human resources to help you complete the assignment. I do ask that you not copy someone else's homework. Please do all the mathematics yourself. By submitting your homework, you implicitly signify that it is your own. This assignment is due at the beginning of class on 26 March 2009.

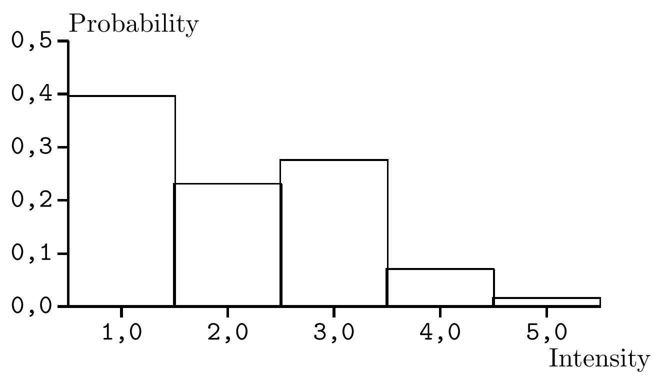
1. Farber & Larson, problem 2, p. 235. Table 1 lists the number of U.S. mainland hurricane strikes (from 1901 to 2004) for various intensities according to the Saffir-Simpson Hurricane Scale.

(a) Construct a probability distribution of the data.
(b) Graph the discrete probability distribution using a probability histogram.
(c) Find the mean, variance, and standard deviation of the probability distribution and interpret the results.
(d) Find the probability that a hurricane selected at random for further study has an intensity of at least four.

(a) See third column of Table 1. Probabilities are found

$$P(1) = \frac{\text{Number of Intensity 1 hurricanes}}{\text{Total number of hurricanes}} = \frac{70}{176} = 0.398$$

(b)



(c)

$$\begin{aligned} x_{\text{mean}} &= \sum_i x_i P(x_i) \\ &= (1)(0.398) + (2)(0.233) + (3)(0.278) + (4)(0.074) + (5)(0.017) \\ &= 2.08 \end{aligned}$$

Intensity	Number of Hurricanes	Probability
1	70	0.398
2	41	0.233
3	49	0.278
4	13	0.074
5	3	0.017

Table 1: The first column shows the intensity evel, and the second column gives the number of hurricanes with that intensity. The last column gives the probability of a hurricane of a given intensity, as found in part (a) of problem 1.

$$\begin{aligned}
\sigma^2 &= \sum_i (x_i - x_{\text{mean}})^2 P(x_i) \\
&= (1-2.08)^2(0.398) + (2-2.08)^2(0.233) + (3-2.08)^2(0.278) + (4-2.08)^2(0.074) + (5-2.08)^2(0.017) \\
&= (1.17)(0.398) + (0.006)(0.233) + (0.85)(0.278) + (3.69)(0.074) + (8.53)(0.017) \\
&= 1.12 \\
\sigma &= \sqrt{\sigma^2} = \sqrt{1.12} \approx 1.1
\end{aligned}$$

On average, the intensity of a hurricane will be 2.08 with a standard deviation of 1.1.

(d) We want the probability of a four or greater hurricane, this is just given by $P(\text{four or greater hurricane}) = P(4) + P(5) = 0.074 + 0.017 = 0.091$.

2. Farber & Larson, problem 20, p. 233. One in four people in the United States owns individual stocks. In a random sample of 12 people, what is the probability that the number owning individual stocks is (a) exactly two?; (b) at least two; and (c) more than two?

(a) This question fits the definition of a binomial experiment with $p = 0.25$, $n = 12$ and $x = 2$. Using these values in the TI-83, we find $P(2) = 0.232$.

(b) Now we want the probability for at least two, ie we want $P(\text{at least two}) = P(2) + P(3) + ... + P(12)$. This is annoying to calculate. Better to find the complement and subtract that from one. So, $P(\text{less than two}) = P(0) + P(1) = 0.032 + 0.127 = 0.159$. So $P(\text{at least two}) = 1 - P(\text{less than two}) = 1 - 0.159 = 0.841$.

(c) For more than than two, we need to calculate $P(\text{more than two}) = P(3) + P(4) + ... + P(12)$. This is just $P(\text{more than two}) = P(\text{at least two}) - P(2) = 0.841 - 0.232 = 0.609$.

3. Farber & Larson, problem 22, p. 227. A newspaper finds that the mean number of typographical errors per page is four. Find the probability that (a) exactly three typographical errors will be found on a page, (b) at most three typographical errors will be found on a page, (c) more than three typographical errors will be found on a page.

(a) This fits the criteria for a Poisson distribution. We have the mean number of errors in an interval (in this case a spatial one rather than a temporal one) to be $\mu = 4$. We want the probability that there are three errors on a particular page, thus $x = 3$. Using the statistical functions on the TI-83 we find $P(3) = 0.195$.

(b) The probability for finding at most three per page is $P(\text{at most three per page}) = P(0)+P(1)+P(2)+P(3) = 0.018 + 0.073 + 0.147 + 0.195 = 0.433$. All values found again with the TI-83.

(c) To find more than three, this is just the complement of finding at most three, $P(\text{more than three per page}) = 1 - P(\text{at most three per page}) = 0.567$.

4. Farber & Larson, problem 17, p. 227. Assume the probability that you will make a sale on any given telephone call is $p = 0.19$. Find the probability that you (a) make your first sale in the fifth call, (b) make your first sale on the first, second, or third call, and (c) do not make a sale on the first three calls.

(a) This problem fits the description of a geometric distribution with $p = 0.19$. Using the TI-83 with $x = 5$ gives $P(5) = 0.082$.

(b) So, $P(\text{first sale on first, second, or third call}) = P(1) + P(2) + P(3) = 0.19 + 0.15 + 0.12 = 0.47$.

(c) $P(\text{no sale on first three calls}) = 1 - P(\text{first sale on first, second, or third call}) = 1 - 0.47 = 0.53$.