Homework 8 Due on March 24

§10.2: 7.
§10.3: 1, 7, 9.
§10.4: 1, 2, 5, 11.
§10.5: 2, 8.

§10.2: The Multinomial Distribution

Question 10.2.7 Suppose that a random sample of fifty observations are taken from the pdf

$$f_Y(y) = 3y^2, \quad y \in [0,1]$$

Let Xi be the number of observations in the interval $[0, 1/4)$, X_2 the number in $[1/4, 2/4)$, X_3 the number in $[2/4, 3/4)$, and X_4 the number in $[3/4, 1)$.
(a) Write a formula for $f_{X_1,X_2,X_3,X_4}(3, 7, 15, 25)$.
(b) Find $\text{Var}(X_3)$.

Question 10.3.1 Show that

$$\sum_{i=1}^{t} \frac{(X_i - np_i)^2}{np_i} = \sum_{i=1}^{t} \frac{X_i^2}{np_i} - n.$$

Question 10.3.7 In a move that shocked candy traditionalists, the M&M/Mars Company recently replaced the tan M&M's with blue ones. More than ten million people had voted in an election to select the new color. On learning of the change, one concerned consumer counted the num- ber of each color appearing in three pounds of M&M's . His tally, shown in the following table, suggests that not all the colors appear equally often—blues, in particular, are decidedly less common than browns. According to an M&M/Mars spokesperson, there are actually three frequencies associated with the six colors: 30% of M&M's are brown, yellow and red each account for 20%, and orange, blue, and green each occur 10% of the time. Test at the $\alpha = 0.05$ level of significance the hypothesis that the consumer's data are consistent with the company's stated intentions.

Color	Number
Brown	435
Yellow	343
Red	318
Oragne	152
Blue	130
Green	129

Question 10.3.9 Records kept at an eastern racetrack showed the following distribution of winners as a function of their starting-post position. All 144 races were run with a full field of eight horses.

Starting Post	1	2	3	4	5	6	7	8
Number of Winners	32	21	19	20	16	11	14	11

Test an appropriate goodness-of-fit hypothesis. Let $\alpha = 0.05$.

Question 10.4.1 A public policy polling group is investigating whether people living in the same household tend to make independent political choices. They select two hundred homes where exactly three voters live. The residents are asked separately for their opinion ("yes" or "no") on a city charter amendment. If their opinions are formed independently, the number saying "yes" should be binomially distributed. Do an appropriate goodness-of-fit test on the the data below with $\alpha = 0.05$.

No. Saying "yes"	Freqency
0	30
1	56
2	73
3	41

Question 10.4.2 From 1837 to 1932, the U.S. supreme Court had 48 vacancies. The table in the next column shows the number of years in which exactly k of the vacancies occurred. At the $\alpha = 0.01$ level of significance, test the pypothesis that these data can be described by a Poisson pdf.

Number of vacancies	Number of years
0	59
1	27
2	9
3	1
4+	0

Question 10.4.5 In rotogravure, a method of printing by rolling paper over engraved, chrome-plated cylinders, the printed paper can be flawed by undesirable lines called bands. Bands occur when grooves form on the cylinder's sur- face. When this happens, the presses must be stopped, and the cylinders repolished or replated. The follow- ing table gives the number of workdays a printing firm experienced between successive banding shutdowns. Fit these data with an exponential model and perform the appropriate goodness-of-fit test at the 0.05 level of significance.

Workdays between shutdowns	Number of observed
$0-1$	130
$1-2$	41
$2-3$	25
$3-4$	8
$4-5$	2
$5-6$	3
$6-7$	1
$7-8$	1

Question 10.4.11 Is the following set of data likely to have come from the geometric pdf, $p_X(k) = (1-p)^{k-1}p, k = 1, 2, ...$?

2	8	1	2	2	5	1	2	8	3
5	4	2	4	7	2	2	8	4	7
2	6	2	3	5	1	3	3	2	5
4	2	2	3	6	3	6	4	9	3
3	7	5	1	3	4	3	4	6	2

Question 10.5.2 Many factors influence a company's decision to relocate to another site. The state of Florida, hoping to attract such relocations, sponsored a study on how different companies view various factors. One part of the study compared the importance of a high-quality workforce to manufacturing firms and to nonmanufacturing firms. At the $\alpha = 0.05$ level of significance, do the following data suggest that the importance of a high-quality work-force is not viewed the same by all types of businesses?

		Manufacturing	Other
Importance	Extremely or somewhat	168	73
	Not very	42	26

Question 10.5.8 A university conducted a study to assess consistency of grading in a multi-section basic statistic course. To that end, the study considered the grade distribution of the course for three instructors. Does the data suggest any inconsistency? Test at $\alpha = 0.05$.

	F	D	C	B	A
801	11	19	18	20	13
842	12	21	16	16	14
845	14	10	18	28	11