Math 247: Test 2 Name: KEY

Test _____/90 points Review _____/ 10 points

On all problems involving probability, you must use the correct notation for full credit on the problem.

4 1. Use your knowledge of the world to determine whether the following events are mutually exclusive:

A = a person lives in Atascadero B = A person lives in SLO C = A person drives a white car

A and B are mutually exclusive YES

A and C are mutually exclusive NO

B and C are mutually exclusive NO

4 2. (4 pts) Use your knowledge of the world to label the pairs of these events as independent or associated.

(a) A person is a water polo player; a person is a good swimmer associated

(b) The numbers you get each time when you roll a die twice independent

12 3. A 2013 Pew poll found that 93% of young adults in the US have internet access.

4 a. If two young adults are randomly selected, what is the probability that they both have internet access?

I = internet access $P(I) = .93$

$P(\text{both}) = P(II) = P(I) \cdot P(I) = (.93)(.93) = .865$

4 b. What is the probability that neither of them have internet access?

$N = I^C$ = no internet access $P(N) = 1 - .93 = .07$

$P(\text{neither}) = P(NN) = P(N) \cdot P(N) = (.07)(.07) = .005$

2 c. What is the probability that exactly one of them will have internet access?

Either IN or NI would be the case where exactly one has internet access.

$P(IN) = P(I)P(N) = (.93)(.07) = .065$

$P(NI) = P(N)P(I) = (.07)(.93) = .065$

So $P(\text{exactly 1}) = .065 + .065 = .130$

2 d. Fill in the table for the probability distribution of X = the number who have internet access.

X	0	1	2
P(X)	.005	.130	.865

✓: $\sum P(x) = .005 + .130 + .865 = 1$

15 4. Suppose you flip a fair coin twice. H = heads, T = tails

3 a. List all the possible outcomes. HH, HT, TH, TT

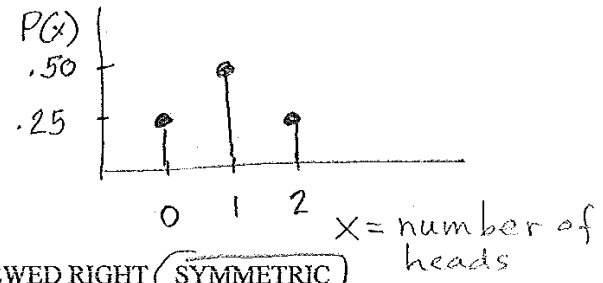
3 b. What is the probability of each outcome? .25

$P(HH) = .25$, $P(HT) = .25$ $P(TH) = .25$ $P(TT) = .25$

3 c. Let X = the number of heads that you get in two flips. Set up a table that shows the probability distribution for X.

X	0	1	2
P(x)	.25	.50	.25

3 d. Graph the probability distribution.
Be sure to label each axis with what it stands for.



3 e. This distribution is (circle one) SKEWED LEFT SKEWED RIGHT (SYMMETRIC)

15 5. The General Social Survey asked 1858 people whether they were registered as a Republican, Democrat, or other, and also asked whether they considered their views as liberal, moderate, or conservative. The given table summarizes the results:

	Dem	Rep	Other	Total
Liberal	306	26	198	530
Moderate	279	134	322	735
Conservative	104	309	180	593
Total	689	469	700	1858

Express each of the following probabilities as a fraction, a decimal to three decimal places, and a percent.

a. What is the probability a person chosen from the entire group is Republican? R = Republican

$P(R) = \frac{469}{1858} = .252 = 25.2\%$ Notation: ½ pt each

b. What is the probability a person chosen from the entire group is both Republican and moderate? M = moderate

$P(R \text{ and } M) = \frac{134}{1858} = .072 = 7.2\%$

c. What is the probability a person chosen from the entire group is either Republican or moderate? (double counted!)

$P(R \text{ or } M) = P(R) + P(M) - P(R \text{ or } M) = \frac{469}{1858} + \frac{735}{1858} - \frac{134}{1858}$

d. What is the probability a person is a Democrat, given that he/she is conservative? $= .576 = 57.6\%$

$P(D \mid C) = \frac{104}{593} = .175 = 17.5\%$

e. What is the probability that a liberal person is Republican?

$P(R \mid L) = \frac{26}{530} = .049 = 4.9\%$

15 6. A poll conducted by the General Social Survey found that 80% of respondents said that their jobs were sometimes or always stressful. Answer the questions below, using the *proper notation*!

(a) If you drew a random sample of 15 workers, how many would you expect to say their job is stressful? Show work!

$n = 15$
$p = .80$

Expected $= \mu = np$
$= 15(.80) = 12$ workers

(b) What is the standard deviation of this distribution? Show work!

$\sigma = \sqrt{np(1-p)} = \sqrt{15(.80)(1-.80)}$ 1.549
$= \sqrt{15(.8)(.2)} = 1.5$ workers

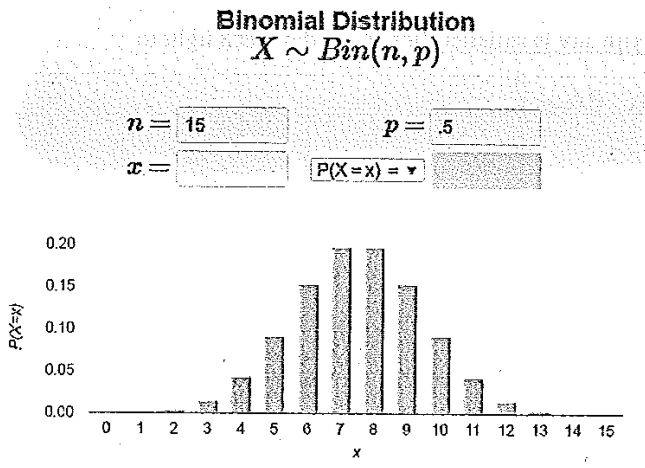
(c) According to the Empirical Rule, if we drew samples of 15 workers over and over again, in 95% of these samples the number of workers who would say they're stressed is between what two values? Show work!

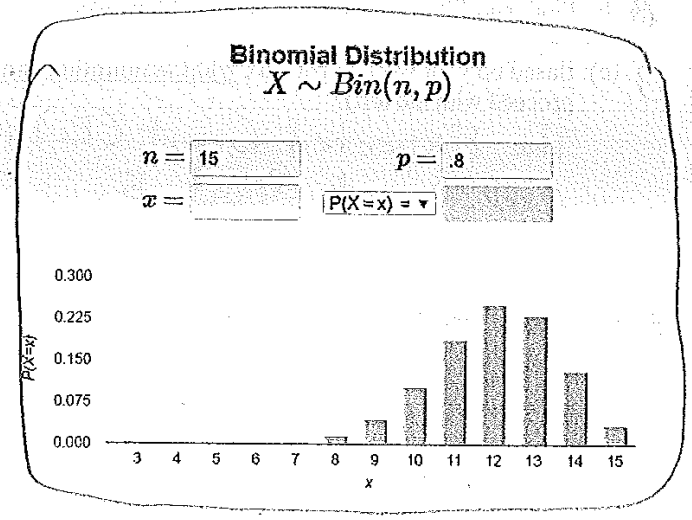
$\mu \pm 2\sigma$
$12 \pm 2(1.5)$
12 ± 3

$12 - 3 = 9$
$12 + 3 = 15$

We'd see between 9 and 15 workers say they're stressed 95% of the time.

(d) Which of the following distributions is the correct one to use in this problem? Circle your answer.





(e) What is the probability that 13 or more of the 15 reported being stressed? Use the distribution values given in the table below to answer this question. **Use proper notation**!

X	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
P(X)	.000	.000	.000	.000	.000	.000	.001	.003	.014	.043	.103	.188	.250	.231	.132	.035

$P(x \geq 13) = P(X = 13 \text{ OR } X = 14 \text{ OR } X = 15)$
$= P(X=13) + P(X=14) + P(X=15)$
$= .231 + .132 + .035$
$= .398 = 39.8\%$

25 7. In Montreal, Canada, an experiment was done with parents of children who were thought to have a high risk of committing crimes when they became teenagers. Some of the families were randomly assigned to receive parental training, and the others were not. The results are summarized in the Two-Way Table below.

Use this information to go through the steps of testing whether or not there is an association between ParentalTraining and Childhood Arrest. Use a significance level of .05.

	Parental Training	No Parental Training	
Arrested (by age 15)	O = 6 E = 11.33	O = 38 E = 32.67	44
Not Arrested (by age 15)	O = 37 E = 31.67	O = 86 E = 91.33	123
	43	124	167

Show work for Expected Counts here:

$E = \frac{44 \times 43}{167} = 11.33$

$E = \frac{44 \times 124}{167} = 32.67$

$E = \frac{43 \times 123}{167} = 31.67$

$E = \frac{124 \times 123}{167} = 91.33$

4 (a) Write the Null and Alternative Hypotheses

H_0: Parental training and childhood arrest are independent (there is no association)

H_1: Parental training and childhood arrest are associated.

8 (b) Find and fill in the expected counts. Show work!

3 (c) Based on your work in part (b), **what assumption can you say is satisfied** (giving us the green light to proceed with the test)?

The Expected Count (E) in each cell is at least 5.

6 (d) Find χ^2 and df by hand. Show work!

$\chi^2 = \frac{(6-11.33)^2}{11.33} + \frac{(38-32.67)^2}{32.67} + \frac{(37-31.67)^2}{31.67} + \frac{(86-91.33)^2}{91.33}$

$\chi^2 = 4.585$ $\quad df = (2-1)(2-1)$

$df = 1$

(e) Use the given Minitab printout to find the P-value and form a conclusion. Be sure to give the conclusion both in terms of whether or not the null hypothesis is rejected and what that means in Laymen's Terms.

6 Conclusion: P-value = .032 < .05

Reject H_0. There is a statistically significant association between parental training and teenage crime. Since this was an experiment we can conclude the training caused the reduction in teen crime.

	Training	No Training
Arrested	6	38
Not Arrested	37	86

Cell Contents: Count

Pearson Chi-Square = 4.584, DF = 1, P-Value = 0.032