Test 11D (Cumulative)   AP Statistics   Name:

Use the following for questions 1 – 3:

A recent poll by Pew research asked 856 randomly selected adults about their education level and whether or not they have a Facebook account. Here are the results.

	Facebook account?		
Education Level	Yes	No	Total
High school or less	157	104	261
Some college	183	67	250
College degree or more	235	110	345
Total	575	281	856

1. If we are interested in whether there is a relationship between education level and use of Facebook, which of the following is the appropriate null hypothesis?

    (a) $H_0 : p_{1,1} = p_{1,2} = p_{1,3} = p_{2,1} = p_{2,2} = p_{2,3}$

    (b) The distribution of Education level is the same for both people who have Facebook accounts and people who don't.

    (c) Sample proportions for the variable "Facebook account" are the same for all education levels.

    (d) The variables "Education level" and "Facebook account" are independent.

    (e) There is an association between the variables "Education level" and "Facebook account."

2. The two-way table below gives the chi-square components for the appropriate test on these data.

	Facebook account?	
Education Level	Yes	No
High school or less	1.92	3.92
Some college	1.35	2.77
College degree or more	0.05	0.09

    Based on this information, which of the following statements are valid?

    I.   The observed counts for the "College degree or more" row are farther from their corresponding expected counts than the observed counts for "High School or less" and "Some college."

    II. "High school or less" individuals differ the most from the sample as a whole.

    III. The observed count for "Some college/No Facebook" is considerably higher than we would expect if the null hypothesis were true.

    (a) I only

    (b) II only

    (c) III only

    (d) II and III only

    (e) I, II, and III are valid.

3. The χ^2 statistic for this test is 10.09. Which of the following gives the correct interval for the P-value of the test?
   (a) P-value < 0.01
   (b) $0.01 < $ P-value < 0.02
   (c) $0.02 < $ P-value < 0.05
   (d) $0.05 < $ P-value < 0.1
   (c) $0.15 < $ P-value < 0.10

4. Which one of the following statements about χ^2 distributions is true?
   (a) A χ^2 distribution with 20 degrees of freedom is more strongly skewed right than a χ^2 distribution with 2 degrees of freedom.
   (b) For any positive number C, $P\left(\chi^2 > C\right) < P\left(\chi^2 > 2C\right)$
   (c) $P\left(\chi^2 > 0\right) = P\left(\chi^2 < 0\right)$
   (d) In any χ^2 distribution, the median is greater than the mean.
   (e) For any χ^2 distribution, $P\left(\chi^2 \geq 0\right) = 1$

5. A consumer electronics store sells a particular brand of protective case for smartphones in four different colors. Below is data on color preference for 76 randomly selected sales of these cases in a three-month period.

Red	Blue	Green	Yellow
23	20	16	17

   For the null hypothesis that the proportion of total sales for each color is the same, what is the expected cell count for "Green"?

   (a) 20   (b) 19   (c) 16   (d) 0.25   (e) 0.21

6. A psychology professor at a large university asks 100 randomly selected students majoring in the humanities and 100 randomly selected math/science majors which of two brands of smartphone they prefer, "Brand A" or "Brand S." Here are her results:

	Brand A	Brand S
Humanities	58	42
Math/Science	47	53

   If the professor wants to determine if humanities and math/science majors differ significantly in their preferences for these two brands, which of the following tests should she use?
   (a) A z-test for the difference of two proportions
   (b) A chi-square goodness of fit test.
   (c) A chi-square test for homogeneity.
   (d) A chi-square test for independence.
   (e) Either (a) or (c).

7. The mean score on Mr. Groucher's AP Calculus test was $\mu = 68.5$ and the standard deviation was $\sigma = 15.4$. The scores were distinctly skewed left. Ace's test score was 58. Which of the following is closest to Ace's z-score?
   (a) −0.68
   (b) −0.15
   (c) 0.15
   (d) 0.68
   (e) It is not appropriate to calculate a z-score for a distribution that is non-Normal.

8. Which one of the following potential problems is addressed by performing a blind study?
   (a) Confounding
   (b) The placebo effect
   (c) Bias associated with voluntary response
   (d) Error arising from random assignment
   (e) Type II error

9. Choose a random shopper at a local grocery store. Let Event P = The shopper is buying some kind of fresh produce. Let Event C = The shopper is paying with a credit card. Below is a Venn Diagram of the probabilities associated with these two events.

   Which one of the two-way tables below conveys the same information?
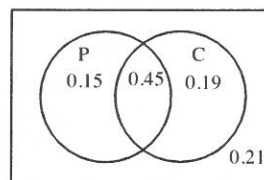
(a)

	P	Pᶜ
C	0.45	0.64
Cᶜ	0.60	0.21

(b)

	P	Pᶜ
C	0.45	0.19
Cᶜ	0.15	0.21

(c)

	P	Pᶜ
C	0.79	0.19
Cᶜ	0.15	0.21

(d)

	P	Pᶜ
C	0.15	0.19
Cᶜ	0.21	0.45

(e)

	P	Pᶜ
C	0.15	0.21
Cᶜ	0.19	0.45

10. Suppose you are conducting a test of significance for which $H_0 : p = 0.7$. Which of the following tests against a specific alternative hypothesis has the greatest power?
    (a) $H_a : p = 0.68$, with $n = 40$ and $\alpha = 0.05$
    (b) $H_a : p = 0.68$, with $n = 80$ and $\alpha = 0.01$
    (c) $H_a : p = 0.68$, with $n = 80$ and $\alpha = 0.005$
    (d) $H_a : p = 0.73$, with $n = 80$ and $\alpha = 0.05$
    (e) $H_a : p = 0.73$, with $n = 40$ and $\alpha = 0.01$

Part 2: Free Response

Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

11. A recent study published in the journal *Pediatrics* examined research on emergency room visits by randomly selected pediatric patients suffering from abdominal pain. The following data was collected on the ethnicity of each patient and whether or not they were given medication for pain relief.

	Given Medication?		
	Yes	No	**Total**
White	330	888	1218
Black	87	465	552
Hispanic	91	392	483
Other	3	42	45
Total	511	1787	2298

(a) Suppose one of these patients were selected at random. what is the probability that she was provided with pain medication, given that she was Hispanic?

(b) In the blank table at right, given the conditional distributions that best illustrate the impact that ethnicity has on treatment for abdominal pain, based on the data above.

	Given Medication?	
	Yes	No
White		
Black		
Hispanic		
Other		

(c) Do these data provide evidence that pediatric patients from different ethnic groups received different treatments for abdominal pain?   The χ^2 statistic for the appropriate test is 39.53 (df = 3) and the *P*-value is nearly 0. Provide the rest of the required information for a complete significance test to support your answer.

12. In a large national survey, middle school students were asked which one of the following they would prefer to be later in life: happy, healthy, famous, or rich. 49% said they would prefer to be happy, 16% said healthy, 15% famous, and 20% rich. Let's assume these percentages represent parameter values for the entire population of U.S. middle school students.

(a) The principle of a large middle school (1000 students) wonders if the preferences of his students differ from the national distribution of preferences. Describe a method by which the principle could select a simple random sample of 80 of his students to survey about their preferences.

(b) The principle employs the methods you described in (a). Here are his results:

Happy	Healthy	Famous	Rich
48	15	9	8

Does this provide evidence that this school's preferences are different from national preferences? Support your answer with appropriate statistical methods.

(c) You had advised the principal to randomly arrange the four options on each of the questionnaires, so that "Happy" only appeared first about one-fourth of the time. He chose not to do this, and asked in the order the data has been presented. Describe one source of bias that might arise from his method and include the direction of that bias.