Final for Statistics 301
Elementary Statistical Methods - Spring 1999
Material Covered: Chapters 1–12 of Workbook and text
10:15am–12:15pm, Monday, 5th May

This is a 2 hour final, worth 34% and marked out of 34 points. The total possible points awarded for each question is given in square brackets at the beginning of each question. Anything that can fit on two sides of an $8\frac{1}{2}$ by 11 inch piece of paper may be used as a reference during this quiz. A calculator may also be used. No other aids are permitted.

Name (please print): ________________________ . **ID Number:** ______.

last first

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1. Consider the following table of the bivariate data of depression–dejection score (a low value indicates deeply depressed or dejected) versus singing ability (a low value indicates bad singing) of ten aging prima donnas.

singing ability, x	23	34	37	42	57	60	72	85	92	100
depression–dejection score, y	10	40	35	47	62	62	73	88	91	93

(a) [1] The correlation coefficient is given by
(circle closest one) **0.94** / **0.95** / **0.96** / **0.97** / **0.98**.

(b) [1] **True** / **False** When the correlation coefficient is close to zero, the scatter plot will always be randomly scattered.

(c) [1] The linear regression equation is given by (circle one)

(i) $\hat{y} = 1.07 - 0.49x$

(ii) $\hat{y} = 1.07x - 0.49x$

(iii) $\hat{y} = 0.49x + 1.07$

(iv) $\hat{y} = 0.49x - 1.07$

(v) $\hat{y} = 1.07x - 0.49$

(d) [1] **True** / **False** When the singing ability is $x = 150$, we can use the linear regression equation to tell us that the approximate depression–dejection score is $\hat{y} = 160.01$.

2. The ages of twenty aging 70's rock stars are given by,

45, 41, 51, 46, 47, 42, 43, 50, 39, 32, 41, 44, 47, 49, 45, 42, 41, 40, 45, 37.

(a) [1] Finish the stem and leaf plot, started below.

3L					
3H	7	9			
4L	0	1	1	1	
4H	5	5	5	6	7
5L	0				
5H					

stem: 10s
leaf: 1s

(b) [1] This data could be described as (circle none, one or more)

(i) discrete (ii) continuous (iii) quantitative (iv) ranked (v) qualitative

(c) [2] According to Chebyshev's rule, a proportion of at least (circle closest one) **56%** / **61%** / **68%** / **83%** / **95%** of the data should fall within 1.5 standard deviations of the average. In fact, a proportion of (circle closest one) **56%** / **61%** / **68%** / **83%** / **90%** falls within 1.5 standard deviations of the average.

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3. [2] In an electric guitar factory, 3.5% of all electric guitars made are assumed to be defective. Technical trouble with the production line, however, has raised the concern that the percent defective has increased in the past few weeks. Of $n = 45$ electric guitars chosen at random, $\frac{4}{45}$ths of them are found to be defective. Match the descriptions in Column I with the statistical terms in Column II.

Column I	Column II
(a) population	**(a)** all guitars
(b) sample	**(b)** percentage defective, of all guitars
(c) statistic	**(c)** 45 guitars
(d) parameter	**(d)** percentage defective, of 45 guitars
	(e) average defective, of all guitars
	(f) defective or nondefective of 45 guitars
	(g) defective or nondefective of all guitars

Column I	(a)	(b)	(c)	(d)
Column II				

4. Five balls are selected at random without replacement from an urn containing four white balls and seven blue balls.

(a) [1] The probability all of the balls are blue is (circle one)

(i) $\frac{C_{4,0}C_{7,5}}{C_{5,11}}$ (ii) $\frac{C_{4,0}C_{5,5}}{C_{11,5}}$ (iii) $\frac{C_{4,0}C_{7,5}}{C_{11,5}}$ (iv) $\frac{C_{4,5}C_{7,5}}{C_{11,5}}$ (v) $\frac{C_{4,0}C_{7,7}}{C_{11,5}}$

(b) [1] The probability exactly three of the balls are blue is (circle closest one)

(i) $\frac{10\times 42}{462}$ (ii) $\frac{3\times 37}{462}$ (iii) $\frac{6\times 35}{462}$ (iv) $\frac{1\times 35}{462}$ (v) $\frac{8\times 24}{462}$

(c) [1] The probability two or three of the balls are blue is (circle closest one)

(i) 0.64 (ii) 0.73 (iii) 0.79 (iv) 0.85 (v) 0.92

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5. Among 450 teenagers pursuing a music career, 245 are in country bands, 190 are in rock bands and 105 are in both country and rock bands. What is the probability that a teenager, selected at random from this group, is in

(a) [1] a country band, or a rock band or both? Circle closest one.

(i) $\frac{245+190+105}{450}$ (ii) $\frac{245-190-105}{450}$ (iii) $\frac{245-190-105}{450}$

(iv) $\frac{245+190-105}{450}$ (v) $\frac{-245+190-105}{450}$

(b) [1] exactly one of these two types of band? Circle closest one.

(i) $\frac{100}{450}$ (ii) $\frac{155}{450}$ (iii) $\frac{215}{450}$ (iv) $\frac{225}{450}$ (v) $\frac{305}{450}$

(c) [1] neither a country band, nor a rock band? Circle closest one.

(i) 0.13 (ii) 0.20 (iii) 0.27 (iv) 0.42 (v) 0.48

6. The hourly earnings, X, of a typical DJ on the radio are given by the following probability distribution.

X	0	20	40	60	80	100	120
P(X = x)	0.07	0.12	0.15	0.14	0.28	0.20	0.04

(a) [1] The expected earnings is $E(X) =$ ____________________,

(b) [1] The standard deviation in earnings is ____________________,

(c) [1] This probability distribution is (circle none, one or more)

(i) skewed right (ii) essentially symmetric (iii) negatively skewed

(iv) skewed left (v) positively skewed

(d) [1] **True** / **False** The random variable is given by X in this case.

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7. A drug manufacturer states that only 5% of the music executives using a particular drug will experience side effects. Assume this problem obeys the conditions of a binomial experiment.

(a) [1] The probability that 15 or fewer of 250 music executives experience side effects is (circle closest one)

(i) 0.77 (ii) 0.81 (iii) 0.84 (iv) 0.88 (v) 0.90

(b) [2] The probability that 100 or fewer of 2500 music executives experience side effects is (circle closest one)

(i) 0.007 (ii) 0.009 (iii) 0.012 (iv) 0.015 (v) 0.017

[Hint: Do not forget the continuity correction.]

8. Suppose we conduct a test of the true average height, in feet, of Grateful Dead fans, called "deadheads", $H_o : \mu = 5.9$ versus $H_a : \mu = 5.2$. We use the decision rule that if $\bar{x} > 5.8$, we will accept the null hypothesis. We base our decision on a random sample of size 38. We also know the standard deviation in the heights of all deadheads to be $\sigma = 2.1$.

(a) [1] **True** / **False** By the central limit theorem, we know that

$$\bar{X} \sim N\left(\mu_{\bar{X}}, \sigma^2_{\bar{X}}\right) = N\left(\mu, \frac{\sigma^2}{n}\right) = N\left(\mu, \left(\frac{2.1}{\sqrt{38}}\right)^2\right)$$

(b) [1] A type II error, β, occurs if, on the basis of the sample average height, (circle one)

(i) it is decided to reject the true average height is 5.9 feet when, in fact, the average height of 5.9 is true.

(ii) it is decided the average height of all deadheads is 5.2 feet tall, when, in fact, it is 5.9 feet tall.

(iii) mistakenly reject the average height is 5.9 feet tall.

(iv) mistakenly accept the average height is 5.9 feet tall.

(v) mistakenly reject the average height is 5.8 feet tall.

(c) [1] The probability of a type II error is (circle closest one)

(i) 0.039 (ii) 0.046 (iii) 0.056 (iv) 0.066 (v) 0.078

(d) [1] The probability of a type I error is (circle closest one)

(i) 0.296 (ii) 0.306 (iii) 0.356 (iv) 0.378 (v) 0.385

9. It is required that the standard deviation in the distance between woofers and other speakers in a casing equal $\sigma = 7$ mm. In a random sample of 37 speaker casings, the standard deviation in the distance between woofers and other speakers was found to be 9 mm. A test is conducted to see if the standard deviation in distance exceeds 7 mm at $\alpha = 0.05$.

(a) [1] The statement of the test, in this case, is (circle one)

(i) $H_o : \sigma = 7$ versus $H_a : \sigma > 7$

(ii) $H_o : \sigma^2 = 7$ versus $H_a : \sigma^2 < 7$

(iii) $H_o : \sigma = 7$ versus $H_a : \sigma < 7$

(iv) $H_o : \sigma^2 = 7$ versus $H_a : \sigma^2 < 9$

(v) $H_o : \sigma = 9$ versus $H_a : \sigma \neq 9$

(b) [1] The critical value, χ^2_α, is (circle closest one)

(i) 50.4 (ii) 51.0 (iii) 51.9 (iv) 52.2 (v) 53.5

(c) [2] The p–value is (circle closest one)

(i) 0.008 (ii) 0.013 (iii) 0.023 (iv) 0.038 (v) 0.041

10. The alcohol levels for a random sample of nine male rock stars and six female rock stars is given by:

males (1)	0.06	0.08	0.07	0.12	0.11	0.06	0.01	0.07	0.02
females (2)	0.11	0.05	0.04	0.04	0.03	0.03			

We are interested in knowing whether the average alcohol levels for the males is the same or different than the average alcohol levels for the females. We know the various alcohol levels all follow a normal distribution.

(a) [1] If we do *not* pool the sample standard deviations, a 95% confidence interval is given by (circle closest one)

(i) $(-0.0111, 0.0542)$ (ii) $(-0.0209, 0.0542)$ (iii) $(-0.0391, 0.0542)$

(iv) $(-0.0411, 0.0542)$ (v) $(-0.0531, 0.0542)$

(b) [1] If we do pool the sample standard deviations, a 95% confidence interval is given by (circle closest one)

(i) $(-0.022, 0.043)$ (ii) $(-0.022, 0.047)$ (iii) $(-0.022, 0.051)$

(iv) $(-0.022, 0.055)$ (v) $(-0.022, 0.060)$

(c) [1] **True** / **False** Since the sample standard deviations are so close to one another, it makes sense to pool these standard deviations.

1. (a) 0.98; (b) False; (c) v; (d) False
2. (a) ii, iii; (b) 56%, 90%
3. g, f, d, b
4. (a) iii; (b) iii; (c) i
5. (a) iv; (b) iv; (c) iii
6. (a) 64; (b) 32.62; (c) iii, iv; (d) True
7. (a) ii; (b) iii
8. (a) True; (b) iv; (c) i; (d) v
9. (a) i; (b) ii; (c) i
10. (a) ii; (b) iv; (c) True