Final for Statistics 301
Elementary Statistical Methods - Fall 1998
Material Covered: entire course
14th December

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. [3] Complete the following distribution table for the cost (in 1000s of dollars) for each of twenty episodes of "Star Trek: Voyager".

class interval	number	relative number	proportion per $1,000
50 to 55	5	0.25	(c)
55 to 61	10	(a)	(d)
61 to 63	4	(b)	(e)
63 to 71	1	0.05	(f)

	(a)	(b)	(c)	(d)	(e)	(f)

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2. [3] Try the following questions.

1. **True** / **False** The standard deviation is always less than the variance.
2. If the number 7 was added to each value in a data set, which of the following measures would remain unchanged? Circle none, one or more. **mode** / **mean** / **median** / **midrange** / **standard deviation**
3. Chebyshev's rule tells us that at least (circle closest one) **75%** / **89%** / **94%** / **96%** / **99%** of a set of observations should fall within four standard deviations of the average.

3. [4] Identify whether the following data is continuous or discrete and also whether it is quantitative, qualitative or ranked.

1. **continuous** / **discrete** and **quantitative** / **qualitative** / **ranked** three (and only three) possible heights of little green men: small, medium and large
2. **continuous** / **discrete** and **quantitative** / **qualitative** / **ranked** square footage of ground razed by death ray
3. **continuous** / **discrete** and **quantitative** / **qualitative** / **ranked** number of times "Danger, Will Robinson, danger!" is spoken in one television episode of "Lost In Space"
4. **continuous** / **discrete** and **quantitative** / **qualitative** / **ranked** possible names of Earthling heroes such as Biff, Bob, Chuck, Flash ...

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4. [3] Match the type of test or CI in Column I with the situation described in Column II. Here, LGM stands for "little green men" (you know, from Mars).

Column I	Column II
(a) test μ, $n < 30$	**(a)** Test average height of Earthlings is 5.5 feet tall using 43 people.
(b) CI σ	**(b)** Test if average height of Earthlings is the same as LGM.
(c) test p_i, $i \geq 2$	**(c)** Estimate difference in proportion of Earthlings over 6 feet tall and proportion of LGM over 6 feet tall.
(d) CI $p_1 - p_2$	**(d)** Test if proportion of Earthlings killed by death rays is the same as the proportion of LGM killed by laser guns.
(e) test μ, $n > 30$	**(e)** Test if average height of LGM is 2.4 feet tall using 15 alien heights.
(f) test μ_i, $i \geq 2$	**(f)** Estimate variance in heights of LGM.

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

5. [4] Consider the following cross–tabulation table of diet and the shade of green of little green men (LGM). For example, 70 LGMs who had a poor diet were a light shade of green.

	diet →	poor	adequate	abundant	row totals
shade	light	70	95	35	200
of	medium	130	450	30	610
green	dark	90	30	70	190
	column totals	290	575	135	1000

1. The number of LGMs who had a poor diet and were a dark shade of green is (circle closest one) **30** / **35** / **70** / **90** / **290**.

2. The number of LGMs who had a poor diet or were a dark shade of green is (circle closest one) **90** / **190** / **290** / **390** / **480**.

3. The number of LGMs who had a poor diet or who were not a light shade of green is (circle closest one) **220** / **290** / **490** / **800** / **870**.

4. The number of LGMs who had a poor diet given they were not a light shade of green is (circle closest one) **220** / **290** / **490** / **800** / **870**.

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6. [4] Let events A, B and C be events of a sample S where A and B are disjoint, B and C are disjoint and $P(A) = 0.35$, $P(B) = 0.08$, $P(C) = 0.07$ and $P(A \text{ and } C) = 0.03$.

1. $P(\bar{A}) =$ _____,

2. $P(A \text{ or } B) =$ _____

3. $P(A \text{ or } C) =$ _____

4. $P(C|A) =$ _____.

7. [3] Try the following questions on discrete probability distributions.

1. If $P(X = x) = \frac{1}{5}$, $x = 5, 6, 7, 8, 9$,

   then $P(6.5 < X < 8.5) =$ _____.

2. If $P(X = x) = \frac{x}{35}$, $x = 5, 6, 7, 8, 9$,

   then $E(X) = \mu =$ _____.

3. If $P(X = x) = \frac{x^2}{90}$, $x = 2, 3, 4, 5, 6$,

   $V(x) = \sigma^2 =$ _____.

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8. [3] Aliens are threatening Earth. The null hypothesis is that we believe, at most, 5% of Earthlings will conspire with the little green men (LGM) to take over the Earth. It turns out, in a random sample of 100 Earthlings, 6 are conspiring with the LGM. Test at $\alpha = 0.05$.

1. **True** / **False** A type I error occurs if greater than 5% of Earthlings conspire with the LGM but we believe otherwise.

2. The p–value

   is _____.

3. Since the p–value is (circle one)

   (a) smaller than the critical value, $z_{0.05}$, we accept that more than 5% of Earthlings are conspiring with the LGM.

   (b) smaller than the critical value, $z_{0.05}$, we reject that at most 5% of Earthlings are conspiring with the LGM.

   (c) larger than the level of significance, $\alpha = 0.05$, we accept the null hypothesis.

   (d) smaller than the observed z test statistic, we accept the alternative hypothesis.

9. [4] According to an X–file, little green men (LGM) come in the four shapes of square, rectangular, oval and circular, in the ratio 1:2:1:4. Suppose, in fact, of 100 LGM, chosen at random, it was found that there was, respectively, $(14, 22, 10, 54)$ square, rectangular, oval and circular LGM.

1. Complete the following table.

	square	rectangular	oval	circular	totals
observed, O_i	14	22	10	54	100
expected, E_i	(a)	(b)	(c)	(d)	100

	(a)	(b)	(c)	(d)

2. The upper critical value, $\chi^2_\alpha = \chi^2_{0.05} =$ (circle closest one) **6.54** / **7.01** / **7.81** / **8.32** / **8.94**.

3. The p–value is (circle closest one) **0.29** / **0.46** / **0.0.56** / **0.63** / **0.71**.

10. [3] Eerie Indiana has had its share of unidentified flying objects (UFO) observations. The number of such sightings per year is recorded by three different Indiana University research laboratories over a five year period.

Indiana	24	26	25	25	30
Purdue	26	30	35	40	45
UIPUI	33	52	43	36	43

1. Complete the following ANOVA table.

Source	Sum Of Squares	Degrees of Freedom	Mean Squares
Between	(a)	(b)	(c)
Within	(d)	(e)	(f)

	(a)	(b)	(c)	(d)	(e)	(f)

2. The statistic MS(between) statistic measures, roughly, (circle one)

   (a) the *average* squared distance the average UFO counts are apart from one another.

   (b) the *total* squared distance the average UFO counts are apart from one another.

   (c) the *average* variability in the UFO count with respect to the average UFO count in each lab.

   (d) the *total* variability in the UFO count with respect to the average UFO count in each lab.

3. The smaller the F statistic, the (circle one) **greater** / **smaller** the chance the average UFO count recorded by the three labs is different.

1. 0.50, 0.20, 0.05, 0.083, 0.10, 0.00625
2. (1) False; (2) SD; (3) 0.9375
3. (1) discrete, ranked; (2) continuous, quantitative; (3) discrete, quantitative; (3) discrete, qualitative
4. e, f, d, c, a, b
5. (1) 90; (2) 390; (3) 870; (4) 220
6. (1) 0.65; (2) 0.43; (3) 0.39; (4) 0.086
7. (1) $\frac{2}{5}$; (2) 7.29; (3) 1.365
8. (1) False; (2) 0.32; (3) accept null
9. (1) 7.81; (2) 0.71
10. (1) 600.4, 2, 300.2, 470, 12, 39.17; (2) (a); (3) smaller