251y0012 10/11/00

ECO251 QBA1 Name ______KEY__________
FIRST HOUR EXAM SECTION MWF 10 11 TR 11 12:30
OCTOBER 7, 2000

Part I. Multiple Choice (10 points)

1.(S-2) Inferential statistics is
a. The display of characteristics of a sample in a graph with summary measures.
b. The display of characteristics of a population in a graph with summary measures.
*c. The process of estimating facts (parameters) about a population from a sample taken from the population.
d. A branch of mathematics devoted to the collection, display and analysis of data.
e. None of the above.

2.(S-3) The Fortune 500 listing of the 500 largest companies in the US in order of their annual sales is an example of
*a. Ordinal data.
b. Nominal data.
c. Interval data.
d. Ratio data.
e. None of the above.

3. A used automobile dealer lists cars in the following classes. A - 100,000 miles or more on the odometer, B - less than 100,000 miles on the odometer, C - Diesel. Are these three categories
*a. Collectively exhaustive?
b. Mutually exclusive?
c. Both mutually exclusive and collectively exhaustive?
d. Neither mutually exclusive or collectively exhaustive?
e. Can't tell with the information given.

4. (D7-9) If a distribution is skewed to the left, we can say that it is likely that
a. Mean > median > mode
b. Median > mean > mode
*c. Mode > median > mean
d. Mode > mean > median
e. Mode = mean = median (Most people got this backwards - make a diagram!)

5. A graph that connects points, each of which represents the cumulative frequency (F) is called a
a. Histogram
*b. Ogive
c. Frequency Polygon
d. Pie chart
e. None of the above

Part II. Compute an appropriate answer, showing your work (except in a)) (15 Points maximum - if you do more than 15 points, only your right answers will be counted.):

a) Fill in the following table (3)

Class	f	f_{rel}	F
50-59.99	___	.12	___
60-69.99	3	___	___
70-79.99	___	___	12
80-89.99	7	___	___
90-99.99	6	___	___
Total	25	___	

Solution:

Class	f	f_{rel}	F
50-59.99	3	.12	3
60-69.99	3	.12	6
70-79.99	6	.24	12
80-89.99	7	.28	19
90-99.99	6	.24	25
Total	25	1.00	

Note that $n = 25$

b) Assume that we have sold 1000 life insurance policies in amounts between $5300 and $9800. If this data is to be presented in seven classes, what intervals would you use? Explain your reasoning using the appropriate formula and make a table showing the class intervals you would actually use. (3)

Solution: $\frac{9800 - 5300}{7} = 642.86$ so use 650 or 700. This is only a suggestion. Any number somewhat above or equal to 643 will work.

Class	from	to
A	5000	5699.99
B	5700	6399.99
C	6400	7099.99
D	7100	7799.99
E	7800	8499.99
F	8500	8199.99
G	9200	9899.99

c) (S-30)If a population of 1000 items with an unknown distribution has a mean of 12 and a standard deviation of 1.5, what is the approximate minimum number of items that must be (i) between 6 and 18? (ii) between 12 and 18? **Note:** there was an error here - (ii) was a harder question than I intended to give - I will thus give 3 points for a correct answer for (i). (ii) should have read (iic) What is the maximum that could be over 18? (3)

Solution: (i) If we use the formula $k = z = \frac{x - \mu}{\sigma}$, we find that $\frac{6 - 12}{1.5} = -4$ and $\frac{18 - 12}{1.5} = 4$. According to the Chebyshef inequality, The minimum fraction of the data that must be between $\mu \pm 4\sigma$ is $1 - \frac{1}{k^2} = 1 - \frac{1}{16} = {}^{15}\!/_{16}$. Fifteen sixteenths of 1000 is about 938. (ii) since we can't pick sides here, the answer can't really be found. (iic) The answer is the opposite to the answer to (i). There are about 1000 - 938 = 62 items left over. All of these could be above 18.

d) Do c) again assuming that the distribution is unimodal and symmetric.(2)
Solution: (i and iic) Since the Empirical Rule says that almost all points must be between $\mu \pm 3\sigma$, we would expect almost all of the 1000 points to be between 6 and 18, since these points are $\mu \pm 4\sigma$, and we would be quite surprised if even one point is above 18. (ii) If the distribution is symmetric, we would expect half of the 1000 points or 500 on one side. Again there will be 2 points for a correct answer to (i).

e) For the numbers 11.1, 13.2, 15.1 and 11.5, compute the i) Root-mean-square ii) Harmonic mean, iii) geometric mean (2 each)
Solution: Note that $\sum x = 50.9$. This is not used in any of the following calculations and there is no reason why you should have computed it!
(i) The Root-Mean-Square.

$$\bar{x}_{rms}^2 = \frac{1}{n}\sum x^2 = \frac{1}{4}\left(11.1^2 + 13.2^2 + 15.1^2 + 11.5^2\right) = \frac{1}{4}(123.21 + 174.24 + 228.01 + 132.25) = \frac{1}{4}657.71$$

$$= 164.4275. \text{ So } \bar{x}_{rms} = \sqrt{\frac{1}{n}\sum x^2} = \sqrt{164.4275} = 12.823.$$

(ii) The Harmonic Mean.

$$\frac{1}{\bar{x}_h} = \frac{1}{n}\sum \frac{1}{x} = \frac{1}{4}\left[\frac{1}{11.1} + \frac{1}{13.2} + \frac{1}{15.1} + \frac{1}{11.5}\right] = \frac{1}{4}(0.090090 + 0.075758 + 0.066225 + 0.086957)$$

$$= \frac{1}{4}(0.319029) = 0.079757. \text{ So } \bar{x}_h = \frac{1}{\frac{1}{n}\sum \frac{1}{x}} = \frac{1}{0.079757} = 12.5380.$$

(iii) The Geometric Mean.

$$\bar{x}_g = \left[x_1 \cdot x_2 \cdot x_3 \cdots\cdots x_n\right]^{\frac{1}{n}} = \sqrt[n]{\prod x} = \sqrt[4]{(11.1)(13.2)(15.1)(11.5)} = \sqrt[4]{25443.198} = (25443.198)^{\frac{1}{4}}$$

$$(25443.198)^{0.25} = 12.6297.$$

Or

$$\ln(\bar{x}_g) = \frac{1}{n}\sum(\ln(x)) = \frac{1}{4}(\ln(11.1) + \ln(13.2) + \ln(15.1) + \ln(11.5)) = \frac{1}{4}(2.40695 + 2.58022 + 2.71469 +$$

$$= \frac{1}{4}(10.14420) = 2.53605. \text{ So } \bar{x}_g = e^{2.53605} = 12.6297.$$ I got the last result by putting 2.53605 into the calculator and pressing 'inverse' and then 'ln x.'

Or

$$\log(\bar{x}_g) = \frac{1}{n}\sum(\log(x)) = \frac{1}{4}(\log(11.1) + \log(13.2) + \log(15.1) + \log(11.5)) =$$

$$= \frac{1}{4}(1.04532 + 1.12057 + 1.17898 + 1.10607) = \frac{1}{4}(4.40557) = 1.10139. \text{ So}$$

$\bar{x}_g = 10^{1.11217} = 12.6297$. I got the last result by putting 1.10139 into the calculator and pressing 'inverse' and then 'log x.'

Notice that the original numbers and all the means are between 11.1 and 15.1. In spite of everything that I said, there are many of you who think that: (i) You can find a sum of squares by summing numbers and squaring the sum; (ii) You can find the sum of $\frac{1}{x}$ by adding up the numbers and taking the reciprocal; (iii) You can find an n^{th} by dividing by n. I can only recommend a remedial math class (unless, of course, you want to try listening in class and checking out the homework very carefully.)