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EASTERN UNIVERSITY, SRI LANKA
SECOND EXAMINATION IN SCIENCE (2004/2005)
FIRST SEMESTER (Jan./Feb., 2006)
ST 205 - STATISTICAL METHODS

Answer all questions

S. Satharathana
 Time allowed: Three hours
S.S. JATHARTHANAN

1. (a) A independent random sample of 280 divorced males and 350 divorced females resulted in the following age distribution.

Age	Sex	
	Male	Female
40 or less	179	268
41 or more	101	82

Is there sufficient evident to conclude that age distribution of divorced males and females are the same?

- (b) In an accounting department the following examining errors of 50 accountants are noted.

Number of errors	Number of accountants
0	25
1	15
2	8
3	0
4	1
5	1

$E = \frac{n \cdot p}{0}$

$P(X > k) = 1 - P(X \leq k)$

$\frac{e^{-\lambda} \lambda^k}{k!}$

Test the hypothesis that the errors are distributed by the Poisson law.

2. What is the disadvantage of sign test?

The data given below are the lung capacities of eight patients tested before and after a new treatment for asthma. Use the binomial distribution to calculate the p-value for the null hypothesis that the treatment has no effect.

Lung capacity of 8 patients

X (Before)	Y (After)
750	850
860	880
950	930
830	860
750	800
680	740
720	760
810	800

3. (a) What are the advantages and disadvantages of a non-parametric test?

(b) Two brands of automobile batteries are to be compared to determine that Brand A has a longer life length than Brand B . Independent random sample of size eight from Brand A batteries and seven from Brand B batteries were put to a test under identical conditions and yielded the following life lengths (in 1000 hours):

Brand A : 11.1 15.8 19.3 18.8 17.3 16.5 12.7 20.9

Brand B : 12.1 13.2 16.5 8.9 10.3 11.2 9.8 21.0

Use the Median test to see if the data support the claim that Brand A batteries last longer than Brand B batteries.

4. (a) For a particular statistics test, a form A and a form B were used for alternate seats. To check whether the two forms were comparable, the order in which the tests were turned in yielded the following sequence:

\overline{A} \overline{B} \overline{A} \overline{B} \overline{A} \overline{A} \overline{B} \overline{B} \overline{A} \overline{A} \overline{A} \overline{B} \overline{A} \overline{B}
 \overline{A} \overline{B} \overline{B} \overline{B} \overline{B} \overline{B} \overline{A} \overline{A} \overline{B} \overline{A} \overline{B} \overline{A} \overline{A} \overline{B}
 \overline{B} \overline{A} \overline{B} \overline{A} \overline{A} \overline{B} \overline{A}

- i. Use the run test to test whether this represents a random sequence of A's and B's against a two-sided alternative hypothesis.
- ii. Use a normal approximation and perform the test.
- iii. What is your conclusion?

(b) Let the total lengths of the male and female trident lynx spiders be denoted by X and Y, respectively, with corresponding distribution functions F(x) and G(y). Measurements of the lengths, in millimeters, of eight male and eight female spiders yielded the following observations of X :

5.40 5.55 6.00 5.00 5.70 5.20 5.45 4.95

and of Y:

6.20 6.25 5.75 5.85 6.55 6.05 5.50 6.65

Use run test to test the hypothesis $H_0 : F(z) = G(z)$ at $\alpha = 0.10$, approximately.

5. A random sample of 42 employees was chosen. The weekly salary increases for the 42 in the sample are given in the following table.

Ratings of 42 employees and their weekly salary increases.

Excellent	Good	Fair	Poor
85	80	78	81
77	70	75	85
74	78	73	76
77	72	80	81
70	74	82	79
74	77	73	76
79	79	74	76
78	78	76	68
82	91	80	80
78	78	78	78

Handwritten notes and calculations surrounding the table, including various numbers like 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, and various mathematical operations like addition, subtraction, and division.

- (a) State the null hypothesis.
- (b) Use the Kruskal-Wallis test to calculate the value of the test statistic.
- (c) What is your decision on the null hypothesis?

6. The observed values of a random sample of size 16 from a continuous distribution that is symmetric about the median m are

$\begin{array}{cccc}
\cancel{2.1} & \cancel{8.0} & \cancel{3.1} & \cancel{4.0} \\
\cancel{8.5} & \cancel{1.1} & \cancel{6.7} & \cancel{1.8} \\
\cancel{8.3} & \cancel{4.9} & \cancel{0.3} & \cancel{6.9} \\
\cancel{1.3} & \cancel{9.9} & \cancel{4.3} & \cancel{2.2}
\end{array}$

Use the Wilcoxon statistic to test the hypothesis $H_0 : m = 5.0$ against the two-sided alternative hypothesis $H_1 : m \neq 5.0$. Let $\alpha = 0.10$. How does this decision compare to that obtained if the sign test was used?