

Indian Statistical Institute, Bangalore
B. Math (II)
First semester 2009-2010
Backpaper Examination : Statistics (I)

Date: 29-12-2009

Maximum Score 60

Duration: 3 Hours

1. To establish a standard for parachute design, a researcher recorded the following fill times, in seconds, for 27 standard parachutes, obtained under controlled test conditions.

.59 .38 .47 .43 .44 .37 .43 .37 .27 .54 .39 .89 .48 .52
.51 .49 .38 .38 .23 .44 .40 .36 .33 .82 .51 .44 .37

- (a) Make a stem and leaf plot of these data.
- (b) Make a histogram of the frequency distribution.
- (c) Find the sample mean \bar{x} .
- (d) Find the sample standard deviation s .
- (e) Find the sample median m .
- (f) Find 100 p percentiles for $p = 0.25$ and 0.75 .
- (g) What proportion of the data lies within $\bar{x} \pm 3s$?
- (h) Draw the box plot and identify the outliers.
- (i) Decide on trimming fraction just enough to eliminate the outliers and obtain the trimmed mean \bar{x}_T .
- (j) Between the box plot and the stem and leaf plot what do they tell us about the data set?

[24]

2. An *istreewallah* comes to ISI campus with a service cart at 8 am. He remains on the campus for at least an hour and his departure time may be assumed to be uniformly distributed over $(9, 9 + \theta)$, $\theta > 0$. Harsha, who likes to sleep till late, is interested in estimating θ so as to optimize his sleeping time without missing on the *istreewallah*. He therefore commissions Neeraja to record the departure time of the *istreewallah* on 5 consecutive weekdays, say, X_1, X_2, \dots, X_5 .

- (a) Help Harsha to estimate θ using *method of moments*.
- (b) Obtain *maximum likelihood estimator* for θ .
- (c) If the data collected by Neeraja on departure times of the *istreewallah* were :
9:20 am, 9:35 am, 9:10 am, 9:40 am, 10:05 am.
Obtain numerical values of various *estimators* for θ obtained above.

[4 + 5 + 3 = 12]

3. Suppose that the proportion θ of defective items in a large consignment of manufactured items is unknown and that the following hypotheses are to be tested:

$$H_0 : \theta = 0.1 \quad vs \quad H_1 : \theta \neq 0.1.$$

Suppose that in a random sample of 100 items, it is found that 16 are defective. State clearly the assumptions you make and test the hypotheses by carrying out a χ^2 test of goodness-of-fit.

[12]

4. Aircrew escape systems are powered by a solid propellant. The burning rate of this propellant is an important product characteristic. Specifications require that the mean burning rate must be 50 cm/sec . We know that the standard deviation of burning rate is $\sigma = 2 \text{ cm/sec}$. The experimenter decides to specify level of significance to be $\alpha = 0.05$. She selects a random sample of $n = 25$ and obtains a sample average burning rate of $\bar{x} = 51.3 \text{ cm/sec}$. What conclusions should she draw? Also obtain p -value.

[12]

5. Ten observations on effective service life in minutes of batteries used in a laptop are as follows:

176, 191, 214, 220, 205, 192, 201, 190, 183, 185.

To investigate the hypothesis that battery life is adequately modelled by a normal distribution draw and interpret probability plot.

[10]