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HNDIT 2nd YEAR 1st SEMESTER EXAMINATION 2012

Probability and statistics

Answer Script

N. B. :- Additionally any other accepted answer can de considered.

(i) population – consists of all subjects that are being studied

(ii) Sampling – is a study of relationships existing between a pop Samples drawn from the pop

(iii) Parameter- is a characteristic or measure obtained by using all the data values for a specific pop

(iv) Statistic – Is a characteristic or measure obtained by using the data values from a sample

(v) Permutation Is an arrangement of n objects in a specific order.

(vi) Combination – a selection of distinct objects without regard to order is called a combination.

(vii) $\sum_{i=1}^{6} fixi$ - sum of the values of i th f value and

$i\ th$ x value

$$i = 1,2,3,4,5,6$$

(viii) $\sum_{i=0}^{s}(a + xi)$ Sum of the values of i th x value and adding a (constants)
I= 0,1,2,3,4,5

(ix) Std deviation – square root of the variance

(x) Expectation of a discrete random variable of a probability distribution is the theoretical average of the variable.

(2) (i) mean deviation $= \dfrac{\sum(|x-\overline{x}|)}{N}$ $\overline{x}$ = 28/6 =4.6

$$= \frac{|6\text{-}4.6| + |8\text{-}4.6| + |3\text{-}4.6| + |5\text{-}4.6| + |4\text{-}4.6| + |2\text{-}4.6|}{6}$$

$$= \frac{1.4+3.4+1.6+0.4+0.6+2.6}{6}$$

$$= 10/6 = 1.6$$

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(ii) Std. deviation $= \sqrt{\frac{\sum(|x-\bar{x}|)^2}{N}}$

$$\bar{X} = \frac{35}{7} = 5$$

$$\sqrt{\frac{(3-5)^2+(2-5)^2+(8-5)^2+(7-5)^2+(6-5)^2+(5-5)^2+(4-5)^2}{7}}$$

$$= \sqrt{\frac{4+9+9+4+1+0+1}{7}}$$

$$= \sqrt{\frac{28}{7}} = \sqrt{4} = 2$$

(iii) (a) $E(x) = \sum x.p(x)$

$= 5 \times 0.1 + 6 \times 0.2 + 7 \times 0.2 + 8 \times 0.3 + 9 \times 0.1 + 10 \times 0.1$

$= 0.5 + 1.2 + 1.4 + 2.4 + 0.9 + 1$

$= 7.4$

(b) $E(x^2) = \sum x^2.p(x)$

$= 5^2 \times 0.1 + 6^2 \times 0.2 + 7^2 \times 0.2 + 8^2 \times 0.3 + 9^2 \times 0.1 + 10^2 \times 0.1$

$= 2.5 + 7.2 + 9.8 + 19.2 + 8.1 + 10$

$= 56.8$

(c) $E(x-\bar{x})^2 = E(x^2) - (\bar{x})^2$

$= 56.8 - (7.4)^2 = 56.8 - 54.7 = 2.1$

(3) $P(x) = \frac{n!}{(n-x)!x!} p^x q^{n-x}$

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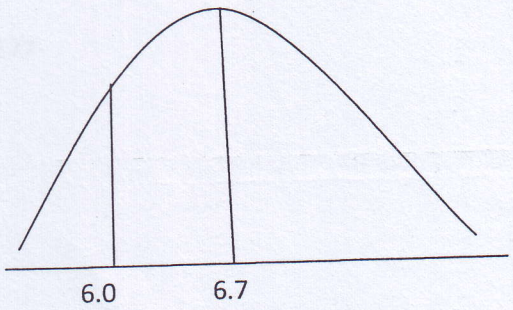
(ii)

- The normal dist curve is bell shaped.
- The mean, median e mode are equal E located at the center of the dist
- The normal dist is continuous, symmetric
- The curve never touché the x-axis
- The normal dist curve is unimodal

(iii) $\mu = 6.7 \quad \delta = 1.2$

(a)

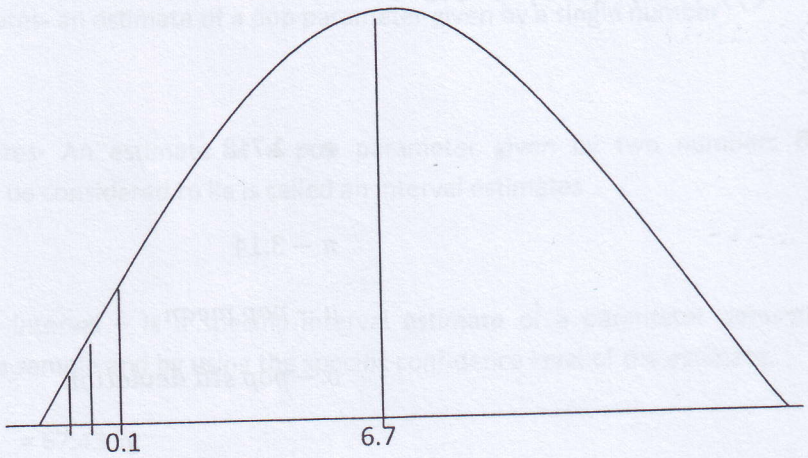


$$Z = \frac{x-\mu}{\sigma} = \frac{6.0-6.7}{1.2} = -\frac{0.7}{1.2} = -0.58$$

$$= \quad 0.5000 - 0.2190$$

$$= \quad 0.2810$$

(b)



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Where,

P(x) = the probability of exactly x successes in n trials.

P= numerical probability of a success

q=numerical probability of a failure

n= no of trials

x= the number of successes in n trials

(ii) mean = np

Variance = npq

Std. deviation = $\sqrt{npq}$

(iii) $(p+q)^s = {}^sc_0\, p^s\, q^0 + {}^sc_1 p^4 q^1 + {}^sc_2 p^3 q^2 + {}^sc_3 p^2 q^3 + {}^sc_4 p^1 q^4 + {}^sc_s p^o q^s$

(iv) n=7, p=0.3 x=0

(a) $p(0) = \binom{7}{0} (0.3)^0 (0.7)^7 = 0.082$

(b) $P(1) = \binom{7}{1} (0.3)^1 (0.7)^6 = 0.247$

(c) P (at least one) = 1-0.082 = 0.918

(d) $P(7) = \binom{7}{7} (0.3)^7 (0.7)^0 = 0.3^7$

(4) (i) $y = \dfrac{e^{\frac{-(x-\mu)^2}{2\sigma^2}}}{\sigma/\sqrt{2\pi}}$

e ~ 2.718

$\pi - 3.14$

$\mu - pop\ mean$

$\sigma - pop\ std\ deviation$

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(b) $P(x=1 / \lambda=2) = (2.7183)^{-2}\ 2\ ^{1}=0.2707)/1!$

(c) $P(x=2 / \lambda=2) = (2.7183)^{-2}\ 2^{2}\ )/2! = 0.2707$

(d) $P(x=3/ \lambda=2) = \frac{(2.7183)^{-2}\ 2^{3}}{3!} = 0.1804$

(e) P(more than s phones will be defective)

= 1-[p (0;2) + p91;2) + p(2;2) + p(3;2) + p(4;2)

= 1- [0.1353 + 0.2707 + 0.2707 + 0.1804+0.0902)

=1-0.9473

=0.0527

(6)

(i) (a) Unbiased Estimates – If the mean of the sampling dist of a statistic equals the corresponding pop – parameter, the statistic is called an unbiased estimator of the parameter. The corresponding values of such statistics are called unbiased estimates.

(b) Efficient estimates – If the sampling dist of two statistics have the same mean then the statistic with the smaller variance is called an efficient estimator of the mean. The corresponding values of the statistics are called efficient estimates.

(c) Point estimates- an estimate of a pop parameter given by a single number

Interval estimates- An estimate of a pop parameter given by two numbers between which the parameter may be considered to lie is called an interval estimates

(d) Confidence Interval – Is a specific interval estimate of a parameter determined by using data obtained from a sample and by using the specific confidence level of the estimate.

(ii) (a) $\bar{x} = \sum \frac{x}{n} = 67.45$ kg

(b) $s^2 = \frac{N}{N-1}\ s^2 = 2.92$

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0.5000- 0.1000 =0.4000

Z = 1.28

$1.28 = \frac{x-6.7}{1.2}$

X= 8.23

(5)

(i) Discrete dist consists of the values a random variable can assume and the corresponding probabilities of the values (counted)

Continuous dist consists of values can assume all values between any two specific values

(ii) $P(x:\lambda) = \frac{e^{-\lambda}\lambda^x}{x!}$

Where x= 0, 1, 2 ...

E= 2.7183

λ - The mean number of occurrences per unit

(iii) mean = λ

Variance –λ

Std deviation = $\sqrt{\lambda}$

(iv) (a) = 0.04

Since $\lambda = np$

Then λ= 50x 0.04 =2

(a) $P(x:\lambda) = (2.7183)^{-2}\ 2^0)/0!$ = 00.1353

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(c) (e) 95% confidence intervals

$$\overline{x} \pm \frac{1.96\,\sigma}{\sqrt{N}} = 67.45 \pm \frac{1.96 \times 2.92}{\sqrt{100}}$$

$$= 67.45 \pm 0.58$$

(d) 99% confidence intervals

$$\bar{X} \pm \frac{2.58\,\sigma}{\sqrt{N}} = 67.45 \pm \frac{2.58 \times 2.92}{\sqrt{100}}$$

$$= 67.45 \pm 0.75$$

(7)

(a) If we want to decide whether one procedure is better than another. We formulate the hypothesis that there is no difference between the procedure. Such hypothesis is called null hypothesis

(b) Alternative hypothesis

Any hypothesis that differs from a given hypothesis is called an alternative hypothesis.

$H_o\ \mu = 1600\ h$ $\qquad$ $H_i\ \mu \neq 1600\ h$

Since $\mu \neq 1600$ includes values both larger e smaller than 1600 a two tailed test should be used.

(a) For a two-tailed test at the 0.0s significance level
Reject H_o, if the z-score of the sample mean is outside the range -1.96 to 1.96

Accept H_o otherwise

$$\delta_{\bar{X}} = \frac{\delta}{\sqrt{N}} = \frac{120}{\sqrt{100}} = 12 \qquad \mu = 1600$$

$$Z = \frac{\bar{X} - 1600}{12} = -2.50$$

Z lies outside the range -1.96 to 1.96 .we reject H_0 at the 0.05 significance level

(b) If the significance level is 0.01 the range -2.58 to 2.58.
Thus since the Z- score of -2.50 lies inside this range, we accept H_o at the 0.01 significance level.