ABE463 CBT CA SOLUTION (2024/25)

Question 1: Z score is used when data is

Answer: A. Greater than 30

Explanation: The Z-score is typically used when the sample size is large (usually greater than 30) because the sampling distribution of the mean approximates a normal distribution due to the Central Limit Theorem.

Question 2: T test is used when data is

Answer: B. Less than 30

Explanation: The t-test is used when the sample size is small (usually less than 30) because the t-distribution accounts for the additional uncertainty in the estimate of the standard deviation.

Question 3: 3% of the electric bulbs manufactured by a company are defective. Find the probability that in a sample of 100 bulbs:

Answer: A. 0.03

Explanation: The probability of a single bulb being defective is 3%, or 0.03. For a large sample size, the probability remains approximately the same.

Question 4: Define variation between treatments

Answer: A. Difference between group means

Explanation: Variation between treatments refers to the differences in the means of different groups or treatments in an experiment.

Question 5: Using a Hypergeometric distribution, determine the probability of drawing 3 clubs in 5 cards without replacement from 5200 cards (1300 club and 3900 non-club)

Answer: B. 0.18

Explanation: The hypergeometric probability formula is:

$P(X = k) = (C(K, k) * C(N-K, n-k)) / C(N, n)$

Where:

- N = 5200 (total cards)
- K = 1300 (club cards)
- n = 5 (cards drawn)
- k = 3 (club cards drawn)

Plugging in the values:

$P(X = 3) = (C(1300,3) * C(3900,2)) / C(5200,5) \approx 0.18$

Question 6: 200 students with 75 intelligent boys have 40 fathers who are educated. Unintelligent boys have 85 fathers who are uneducated. Find the expected variable for:

- A. Intelligent boys with non-educated fathers: 75 - 40 = 35
- B. Non-intelligent boys with educated fathers: 125 - 85 = 40
- C. Non-intelligent boys with uneducated fathers: 85

Question 7: Meaning of rejecting null hypothesis mean

Answer: B. There is significant difference

Explanation: Rejecting the null hypothesis means that there is sufficient evidence to conclude that there is a significant difference or effect.

Question 8: Calculate the probability:
Given: Mean = 220, standard deviation = 40

a) Between 180 and 210
$P(180 < X < 210) = P((-1 < Z < -0.25)) = 0.3085 - 0.1587 = 0.1498 \approx 0.15$
Answer: A. 0.15

b) Below 180
$P(X < 180) = P(Z < -1) = 0.1587 \approx 0.16$
Answer: Not listed, but closest to 0.15.

Question 9: Find m3, m4 given m'1, m'2, m'3
Answer: A. Moment around the mean
Explanation: m3 and m4 are moments around the mean, which are used to calculate skewness and kurtosis.

Question 10: Formula for moment and dimensionless formula
Answer: D. All of the above
Explanation: All the formulas listed are related to moments and dimensionless measures.

Question 11: A = 48, 49, 50, 49; B = 47, 49, 48, 48; C = 49, 51, 50, 50
- Variation: Calculate the variance for each group.
- Grand Mean: Average of all data points.
Grand Mean = (48+49+50+49+47+49+48+48+49+51+50+50) / 12 = 49

Question 12: Probability that a person weighs above 200 lb
Given: Mean = 180 lb, standard deviation = 15 lb
$P(X > 200) = P(Z > (200-180)/15) = P(Z > 1.33) = 1 - 0.9082 = 0.0918 \approx 0.09$
Answer: Not listed, but closest to 0.05.

Question 13: Probability that more than one bulb is defective in a sample of 30 bulbs using Poisson distribution
Given: $\lambda = 0.3$ (1% of 30 bulbs)
$P(X > 1) = 1 - P(X = 0) - P(X = 1) = 1 - e^{(-0.3)} - 0.3e^{(-0.3)} = 1 - 0.7408 - 0.2222 = 0.0369$
Answer: B. 0.0369

Question 14: Z-score for breaking strength
Given: Mean = 1800 kg, standard deviation = 100 kg, sample mean = 1850 kg, n = 50
$Z = (1850 - 1800) / (100 / \sqrt{50}) = 50 / 14.14 = 3.54$
Since $Z > 2.33$ (critical value for $\alpha = 0.01$), we reject the null hypothesis.
Answer: A. Yes, at 0.01 significant level

Question 15: $Xr = \Sigma f(xr) / N$ is what?

Answer: A. rth moment

Explanation: This is the formula for the rth moment about the origin.

Question 16: Fill in the blank space for dice probabilities

Answer: For x = 7, P(x) = 6/36 = 1/6.

Question 17: Chi-square is used in all of the following except

Answer: D. Paired sample testing

Explanation: Chi-square is not used for paired sample testing; it is used for independence, goodness-of-fit, and equality of variances.

Question 18: Hypergeometric probability of picking 2 men in a sample of 6 from 10 people (5 men)

Answer: A. 0.45

Explanation: Using the hypergeometric formula:

P(X = 2) = (C(5,2) * C(5,4)) / C(10,6) = 0.45

Question 19: Chi-square test for fairness

Answer: The large p-value (0.411) suggests that the throwing is fair.

Question 20: Normal distribution probabilities

Answer: Use standard normal tables to find probabilities.

Question 21: Level of significance

Answer: A. The maximum probability at which we are willing to risk rejecting a hypothesis when it should be accepted.

Question 22: Poisson distribution with mean 0.72

Answer: Calculate P(X = 0, 1, 2, 3) using the Poisson formula:

P(X = k) = (e^(-λ) λ^k) / k!

For λ = 0.72, the probabilities are approximately 0.49, 0.35, 0.13, and 0.03.

Question 23: Null hypothesis is used for

Answer: A. Rejecting or accepting hypothesis

Explanation: The null hypothesis is used to determine whether to reject or accept it based on the data.

ABE 463 2022/2023 SET

1) $\mu = 6$ $x = 3$ customers or less $P = \frac{\mu^x e^{-\mu}}{x!}$

$x = (0, 1, 2, 3)$

$P = P_0 + P_1 + P_2 + P_3$ (or use calculator)

$P_0 = \frac{6^0 e^{-6}}{0!} = 0.0025$

$P_1 = 0.0149$

$P_2 = 0.0446$

$P_3 = 0.0892$

$P = 0.0025 + 0.0149 + 0.0446 + 0.0892 = \boxed{0.1512}$

2) $p = 3\% = 0.03$, $q = 97\% = 0.97$ $P = {}^nC_x\, p^x q^{n-x}$

$n = 100$, $x = 2$

$P = {}^{100}C_2 \times 0.03^2 \times 0.97^{100-2}$

$= 0.2252$

3) $P = 20\% = 0.2$, $q = 80\% = 0.8$ $(q = 1 - p)$

$n = 4$, $x = 1$

$P = {}^4C_1 \times 0.2^1 \times 0.8^{4-1}$

$= 0.4096$

4) $N = 100$, $n = 4$, $m = 20$, $x = 4$

With replacement:

$F(x) = {}^nC_x \left(\frac{M}{N}\right)^x \left(1 - \frac{M}{N}\right)^{n-x}$

$= {}^{4}C_{4}\left(\frac{20}{100}\right)^{4}\left(1-\frac{20}{100}\right)^{4-4}$

$= 0.0013$

Without replacement

$P(x) = \frac{{}^{M}C_{x} \; {}^{N-M}C_{n-x}}{{}^{N}C_{n}}$

$= \frac{{}^{20}C_{4} \times {}^{100-20}C_{4-4}}{{}^{100}C_{4}} = \frac{{}^{20}C_{4} \times {}^{80}C_{0}}{{}^{100}C_{4}}$

$= 0.0012$

5)

6) $P = 3\% = 0.03$, $q = 97\% = 0.97$, $n = 100$, $x = 6$

$P = {}^{100}C_{6} \times 0.03^{6} \times 0.97^{100-6}$

$= 0.0496$

7) $N = 10$, $M = 5$, $n = 6$, $x = 2$

without replacement

$P(x) = \frac{{}^{5}C_{2} \times {}^{10-5}C_{6-2}}{{}^{10}C_{6}} = \frac{{}^{5}C_{2} \times {}^{5}C_{4}}{{}^{10}C_{6}}$

$= 0.2381$

8) $P = 3\% = 0.03$, $q = 97\% = 0.97$, $n = 100$, $x = 1$

$P = {}^{100}C_1 \times 0.03^1 \times 0.97^{100-1}$

$= 0.1471$

9) $P = 0.03$, $q = 0.97$, $n = 100$, $= 4$

$P = {}^{100}C_4 \times 0.03^4 \times 0.97^{100-4} = 0.1706$

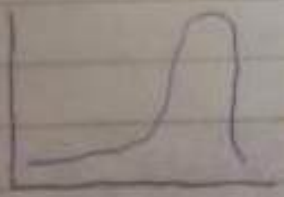
10) $r = 0.0$, $rho = 0$, $T_{cal} = 8.0$, $T_{tab} = 1.7$

$t_{cal} > t_{tab}$

reject the null hypothesis

11) when $r = 0.00$ there is no correlation

12)



Negative skewness

probability of selecting 2 women and 2 men +

14) $V_e = \frac{1}{b}\sum_j T_j^2 - \frac{T^2}{ab}$

15)

16) Level of significance :- In testing a given hypothesis, the maximum probability with which we are willing to risk a type I error

17)

18)

19) $P = 0.03$, $q = 0.97$, $n = 100$

x = at least one ($x \geq 1$)

$P_{(x \geq 1)} = 1 - P_{(x < 1)}$

when $x < (x < 1)$, $x = 0$

$P_0 = {}^{100}C_0 * 0.03^0 \times 0.97^{100-0} = 0.0476$

$\therefore P_{(x \geq 1)} = 1 - 0.0476 = \boxed{0.9524}$

20) $P = 0.03$, $q = 0.97$, $n = 100$

To pick 3 $\therefore x = 3$

$P = {}^{100}C_3 \times 0.03^3 \times 0.97^{100-3}$

$= \boxed{0.2275}$

To pick 10, $x = 10$

$P = {}^{100}C_{10} \times 0.03^{10} \times 0.97^{100-10}$

$= \boxed{0.0007}$

22) $\mu = 0.72$, $x = 2$

$f(x) = \dfrac{\mu^x e^{\mu}}{x!} = \dfrac{0.72^2 e^{-0.72}}{2!}$

$= \boxed{0.1262}$

23) $\mu = 5$, $x = 2$

$f(x) = \dfrac{5^2 e^{-5}}{2!} = 0.0842$

2.4) $n = 4$, $P(A) = \frac{1}{6}$, $q = \frac{5}{6}$, $x = 2$

$f(x) = {}^{4}C_{2} \left(\frac{1}{6}\right)^{2} \left(\frac{5}{6}\right)^{4-2} = \boxed{0.1157}$

2.5) $P = 0.01$, $q = 1 - P = 1 - 0.01 = 0.99$, $n = 100$

x = greater than 2, $\mu = nP = 100 \times 0.01 = 1$

Poisson, $f(x) = \frac{\mu^{x} e^{-\mu}}{x!}$

Probability of greater than 2 = 1 − Probability of 2 or less

$x = 1, 2$

$f(1) = \frac{1^{1} e^{-1}}{1} = 0.3679$

$f(2) = \frac{1^{2} e^{-1}}{2} = 0.18395$

$P(x > 2) = 1 - (f(1) + f(2)) = 1 - (0.3679 + 0.18395)$

$= 1 - 0.5519 = \boxed{0.44481}$

2.6) $P = 0.1$, $q = 0.9$, $n = 10$, $x = 2$

$F(x) = {}^{10}C_{2} (0.1)^{2} (0.9)^{10-2}$

$= \boxed{0.1937}$

27 & 28) Selecting 3 men and 1 woman out of 7 men and 3 women. Total people = 10, total to be chosen = 4

$$\frac{{}^{7}C_{3} \times {}^{3}C_{1}}{{}^{10}C_{4}} = \boxed{\frac{1}{2} = 0.5}$$

Selecting at least 2 women

= Probability of selecting 2 women and 2 men + Probability of selecting 3 women and 1 men

$$= \frac{{}^{7}C_{2} \times {}^{3}C_{2}}{{}^{10}C_{4}} + \frac{{}^{7}C_{1} \times {}^{3}C_{3}}{{}^{10}C_{4}}$$

$$= \boxed{0.333}$$

29) No. to be chosen = 5, Ghanaians = 6, Nigerians = 8, Gambians = 5

Total people = 19

i) No restrictions :- ${}^{19}C_{5} = \boxed{11628}$

ii) At most 2 Ghanians :-

no Ghanaian + one Ghanaian + two Ghanaians
and 5 others and 4 others and 3 others

no of others = 8+5 = 13

$$= \left({}^{13}C_{5}\right) + \left({}^{6}C_{1} \times {}^{13}C_{4}\right) + \left({}^{6}C_{2} \times {}^{13}C_{3}\right)$$

$$= \boxed{9867}$$

iii) One Nigerian and 4 others

no of others = 6+5 = 11

$$= {}^{8}C_{1} \times {}^{11}C_{4}$$

$$= \boxed{2640}$$

• Now,

$$^{n}C_{r} + {}^{n}C_{r-1}$$

$$= \frac{n!}{r!(n-r)!} + \frac{n!}{(r-1)!(n-r+1)!}$$

$$= \frac{n!}{(r-1)!(n-r)!}\left[\frac{1}{r} + \frac{1}{(n-r+1)}\right]$$

$$= \frac{n!}{(r-1)!(n-r)!}\left[\frac{(n+1)}{r(n-r+1)}\right]$$

$$= \frac{(n+1)!}{r!(n-r+1)!} = \boxed{{}^{(n+1)}C_{r}}$$

1) $P(6) = 1/6$.

n = number of rolls = 4

$q = 5/6$

$= {}^{n}C_x (P)^x (q)^{n-x}$

x = exactly 2.

$= {}^{4}C_2 \left(\frac{1}{6}\right)^2 \left(\frac{5}{6}\right)^2$

$= \frac{25}{216} = 0.1157$

2) $P = 0.01$

$q = 1 - P = 1 - 0.01$

$q = 0.99$

$n = 100$ screws

x = greater than '2' defective screw.

Using Poisson or Binomial Imparewn.

Solution.

$\mu = nP$.

$= 100 \times 0.01$

$= 1$

Poisson, $f(x) = \frac{\mu^x e^{-\mu}}{x!}$

for $x = 0, 1, 2$.

for x greater than 2 = 1 − x lesser than 2

$P(x > 2) = 1 - P(x < 2)$

$P(x < 2) =$ sum 1 to 2.

$f(x)$ at $x = 0 = \frac{\mu^0 e^{-\mu}}{0!} = \frac{1^0 \times e^{-1}}{0!}$

$F(x) = \frac{1^0 \times e^{-1}}{0!} + \frac{1^1 \times e^{-1}}{1!} + \frac{1^2 \times e^{-1}}{2!}$

$= e^{-1}\left[\frac{1^0}{0!} + \frac{1^1}{1!} + \frac{1^2}{2!}\right]$

$= 0.3679\ e^{-1}\left[1 + 1 + \frac{1}{2}\right]$

$= e^{-1}\left[\frac{3}{2}\right]$

$P(x < 2) = 0.5519$

$P(x > 2) = 1 - P(x < 2)$

$= 1 - 0.5519$

$= 0.4481$

$\simeq 0.45$

3) $P(x) = {}^nC_x\, p^x\, q^{n-x}$

$n = 10$, $x = 2$

$p = 10\% = 0.1$

$q = 90\% = 0.9$

$= {}^{10}C_2\,(0.1)^2\,(0.9)^8$

$= 0.1937$

4) Same as

5) T-test is used to compare the means of 2 groups.

T-test is used when sample size is small.

6) ANOVA → Analysis of variance

7) Boys = 7 $P(B) = 7/10$

Girls = 3 $P(G) = 3/10$

x = Exactly 12 girls

$= {}^nC_x\,(P)^x\,(1-q)^{n-x}$

$= {}^{10}C_2\,(3/10)^2\,(7/10)^8$

$= 0.2335$

8) $\mu = 220\text{kg}$

$\sigma = 40\text{kg}$

x = Between 180kg and 270kg.

Solution.

$$Z = \frac{x - \mu}{\sigma}$$

$Z_1 = \frac{180 - 220}{40} = \frac{-40}{40} = -1$

$Z_1 = -1$

$Z_2 = \frac{270 - 220}{40} = \frac{50}{40} = 1.25$

$Z_2 = 1.25$

From table

Z_1 on table gives $\rightarrow 0.1587$

$Z_2 \rightarrow 0.8944$

$Z_2 - Z_1 = 0.8944 - 0.1587$

$P = 0.7357$

9) Coefficient of skewness is a measure of the degree of assymetry of a probability distribution.

10)

11) $\mu = 180\,lb$

$\sigma = 15\,lb$

Minimum $= 180\,lb$

Maximum $= 180\,lb$

from calculator.

$P = 0.4088$

12) Similar to 11 but variance = 15

S.D = $\sqrt{15}$ ∴ P = 0.4999

13) Null hypothesis is a statement that assumes there is no significant difference between two populations or two sets of data

14) Correlation is a statistical measure that describes the strength and direction of a relationship between two variables.

1 Correlation is a quantitative

15) $g = 0$

$t_{cal} = 5$ . . .

$t_{tab} = 1$ . . .

$t_{cal} > t_{tab}$ → reject the null hypothesis

16)

Height (in)	Class mark (x)	frequency (f)
60 - 62	61	5
63 - 65	64	18
66 - 68	67	42
69 - 71	70	27
72 - 74	73	8

Solution.

X	$u = \frac{X-A}{c}$	f	fu	fu^2	fu^3	fu^4
61	-2	5	-10	20	-40	80
64	-1	18	-18	18	-18	18
A-67	0	42	0	0	0	0
70	1	27	27	27	27	27
73	2	8	16	32	67	128
Σ		100	15	97	33	253

$$m_1' = c\frac{\Sigma fu}{N} = 3 \times \left(\frac{15}{100}\right) = 0.45$$

$$m_2' = c^2\frac{\Sigma fu^2}{N} = 3^2 \times \left(\frac{97}{100}\right) = 8.73$$

$$m_3' = c^3\left(\frac{\Sigma fu^3}{n}\right) = 3^3 \times \left(\frac{33}{100}\right) = 8.91$$

$$m_4' = c^4\left(\frac{\Sigma fu^4}{N}\right) = 3^4 \times \left(\frac{253}{100}\right) = 204.93$$

Thus $M_1 = 0$

$M_2 = m_2' - (m_1')^2 = 8.73 - (0.45)^2 =$

$M_2 = 8.5275$

$M_3 = m_3' - 3m_1'm_2' + 2(m_1')^3 = 8.91 - 3(6.73 \times 0.45) + 2(0.45)^3$; $M_3 = -2.69325$

$M_4 = m_4' - 4m_1'm_3' + 6(m_1')^2m_2' - 3(m_1')^4$

$= 204.93 - 4(6.45 \times 8.91) + 6(0.45^2 \times 8.73) - 3(0.45)^4$

$M_4 = 199.3759$

$M_1 = 0$

$M_4 = 199.3759$

$M_2 = 8.5275$

$M_3 = -2.69325$

17) Which is the strongest R.

$R = 0.65$

$R = 0.60$

$R = 0.40$

18) F-test is a statistical test that is used to compare the variance of two populations. It is also used to determine whether the means of several groups are equal.

19) PM Correlation has the strongest linear relationship between two variables.

20) Dimensionless skewness $= a_3 = \frac{M_3}{S^3} = \frac{M_3}{(\sqrt{M_2})^3}$

21) Skewness is the degree of asymmetry of a distribution.

Kurtosis is the degree of peakedness of a distribution.

22) Dimensionless moment of kurtosis $= a_4 = \frac{M_4}{S^4} = \frac{M_4}{(\sqrt{M_2})^4}$

$$a_4 = \frac{M_4}{M_2^2}$$

23) For moment $\Rightarrow$ $\frac{M_r}{S^r} = \frac{M_r}{(\sqrt{M_2})^r}$

24)

25) $X^2 = \sum \frac{(O-E)^2}{E}$ $\Rightarrow$ chi-square

26) Alternative hypothesis.

27) $F(x) = \frac{\mu^x e^{-\mu}}{x!}$ $\rightarrow$ Poisson's distribution

$\mu = 5$ (calls per hour)

$x = 2$

$= \frac{5^2 e^{-5}}{2!} =$

$f(x) = 0.08422$

28) Null hypothesis.

29) Weakest $r \rightarrow r = 0.00$ (least strength)

30) Z score is used when data is greater than 30

31) T-table is used when data is less than 30.

32) $\mu = 2$ cars per minute

$x =$ Greater than 4 cars.

Solution.

$P(x > 4) = 1 - P(x < 4)$

$P(x < 4) = 0, 1, 2, 3$

From calculator:

$P = 0.14287$

33) $\mu = 6$

x = at most 3 cars $= 0, 1, 2, 3$

from calculator using Poisson distribution.

$P = 0.1513$

34) Hypergeometric distribution

$$P(X = k) = \frac{\binom{K}{k}\binom{N-K}{n-k}}{\binom{N}{n}}$$

where N = population size

K = number of success states in the population

n = number of draws.

k = number of successes

$\binom{a}{b}$ = binomial coefficient

$$= \frac{\binom{M}{x}\binom{N-M}{n-x}}{\binom{N}{n}}$$

$N = 5200$ cards

$M = 1300$ clubs

$n = 5$ cards → number of draws.

$x = 3$ clubs

$$P(x) = \frac{{}^{1300}C_3 \times {}^{5200-1300}C_{5-3}}{{}^{5200}C_5}$$

$$= 0.08783$$

36) Same as 32

37) $x = 270\text{kg}$

Average weight, $\mu = 220\text{kg}$

$\sigma = 40\text{kg}$

Solution:

from calculator

$$P = 4.566 \times 10^{-3} \; *$$

$$Z = \frac{x - \mu}{\sigma} = \frac{270 - 220}{40} = 1.25$$

from table → $P = 0.8944$

38) $m_1 = 0$

$m_2 = 8.52$

$m_3 = -2.69$

$m_4 = 199.37$

39) $P = 20\% = 0.2$

$q = 80\% = 0.8$

$n = 4$

Solution:

i) P(1 book will be defective)

$x = 1$

$= {}^nC_x P^x q^{n-x}$

$= {}^4C_1 (0.2)^1 (0.8)^3$

$= 0.4096$

ii) P(0 books will be defective):

$x = 0$

$= {}^4C_0 (0.2)^0 (0.8)^4$

$= 0.4096$

iii) P(at most 2 will be defective) $\Rightarrow x = 0, 1, 2.$

$P(x) = P(0) + P(1) + P(2)$

$P(2) = {}^4C_2 (0.2)^2 (0.8)^2 = 0.1536$

P(at most 2) $= 0.4096 + 0.4096 + 0.1536$

$= 0.9728$

40) $P = 0.4$

$q = 0.6$

$n = 5$.

i) P(none will graduate) $\rightarrow x = 0$

$= {}^nC_x \, p^x \, q^{n-x}$

$= {}^5C_0 \, (0.4)^0 (0.6)^5$

$= 0.07776$.

ii) P(1 will graduate) $\rightarrow x = 1$

$= {}^5C_1 \, (0.4)^1 (0.6)^4$

$= 0.2592$

iii) P(at least 1 will graduate) $\rightarrow P(x \geq 1)$

$= 1 - P(x \leq 1)$

$P(x \leq 1) = x = 0 + x = 1$

$= 0.07776 + 0.2592$

$= 0.33696$

$= 1 - 0.33696 = 0.92224$

iv) P(all will graduate) $\Rightarrow x = 5$

${}^5C_5 \, (0.4)^5 (0.6)^0$

$= 0.01024$

41) Probability distribution.

Mean = np

S.D = $\sqrt{npqr}$

42) $n = 6$

x = exactly 2

But $P = 1/2$

$q = 1/2$

$P(x) = {}^6C_2 (1/2)^2 (1/2)^4$

$= 15/64 = 0.2344$

43) P(at least 4) head in a 6 tosses of a fair coin.

Solution.

$n = 6$. $P = 1/2$; $q = 1/2$

x = at least 4

P(at least 4) = $P(x \geq 4)$

$x = 4, 5, 6$

$P(4) + P(5) + P(6)$

$P(x) = {}^nC_x p^x q^{n-x}$

${}^6C_4 (1/2)^4 (1/2)^2 + {}^6C_5 (1/2)^5 (1/2)^1 + {}^6C_6 (1/2)^6$

$= 0.34375$

44) $P = 10\% = 0.1$

$q = 90\% = 0.9$

$n = 10$ $x =$ exactly 2.

a) Use Binomial distribution

b) Poisson distribution.

Solution.

a) ${}^nC_x p^x q^{n-x}$

$= {}^{10}C_2 (0.1)^2 (0.9)^8$

$= 0.1937$

b) Mean, $\mu = np = 10 \times 0.1 = 1$

$= \frac{\mu^x e^{-\mu}}{x!}$

$= \frac{1^2 \times e^{-1}}{2!}$

$= 0.1839$

45) $X^2 = \sum \frac{(O - E)^2}{E}$

$X^2 = 10.34$

Corresponding P value $= 0.411$. The finding is fair

46) $P = 3\% = 0.03$

$q = 0.97$

$n = 100$

a) 0 (b) 1 (c) 2 (d) 3 up to 5 number of defective.

Solution:

a) $x = 0$

$P(x) = {}^{n}C_x \, p^x \, q^{n-x}$

$= {}^{100}C_0 \, (0.03)^0 \, (0.97)^{100}$

$= 0.04755$

b) $x = 1$

$P(x) = 0.14707$

c) $x = 2$

$P(x) = 0.2252$

d) $x = 3$

$P(x) = 0.2275$

e) $x = 4$

$P(x) = 0.1706$

f) $x = 5$

$P(x) = 0.1013$

47) $\mu = 0.72$

$x = 2$

$$P(x) = \frac{\mu^x e^{-\mu}}{x!}$$

$$= \frac{0.72^2 \times e^{-0.72}}{2!}$$

$P(x) = 0.1262$

48) $n = 12$

$r = 0.6241$

Check the hypothesis to accept or reject.

Solution:

$$t_{cal} = \frac{r - B}{\sqrt{\frac{1 - r^2}{n - 2}}}$$

$$= \frac{0.6241 - 0}{\sqrt{\frac{1 - 0.6241^2}{12 - 2}}}$$

$df = n - 2$

$df = 10$

$t_{cal} = 2.5259$

49) find t_{cal} if $n = 20$ and $r = -0.971$

$$t_{cal} = \frac{-0.971 - 0}{\sqrt{\frac{1 - (-0.971)^2}{20 - 2}}}$$

$t_{cal} = -17.2311$

50)

51) Probability of obtaining 6 when a fair die is rolled 6 times.

Solution.

$P(6) = 1/6$

$q(6) = 5/6$

$n = 6$

$x = 1$

$= {}^nC_x P^x q^{n-x}$

$= {}^6C_1 (1/6)^1 (5/6)^5$

$= 0.4019$

$= 0.40187$

52) $\mu = 65$

$S.D = \sigma = 4$

Find x = less than 60

Solution.

$P(x) = x$ $\quad Z = \dfrac{x - \mu}{\sigma}$

$Z = \dfrac{60 - 65}{4} = -1.25$

P value = 0.1056

53) $n = 100$

$p = 0.01$

$\mu = np = 1$

$P(x) = \frac{\mu^x e^{-\mu}}{x!}$

$\Rightarrow$ Same as p.

54) Strongest $r \rightarrow 0.85$

55)

56) Same as 43

57)

58) $p = 10\% = 0.1$

$n = 8$

$q = 0.9$

$x = 2$

$= {}^8C_2 (0.1)^2 (0.9)^6$

$P(x) = 0.1488$

59) $t_{cal} = 6.0887$

$t_{tab} = 1.7709$

$t_{cal} > t_{tab} \rightarrow$ reject null hypothesis

60)

61) Hypergeometric distribution

$N = 10 \quad n = 2$

$M = 3 \quad x = 2$

Solution:

$$\frac{\binom{M}{x} \times \binom{N-M}{n-x}}{\binom{N}{n}}$$

$$= \frac{{}^{3}C_2 \times {}^{7}C_0}{{}^{10}C_2}$$

$$= 1/15$$

62)

63) $N = 10$ → Population size

$M = 5$ → number of success states.

$n = 6$ → number of draws selected at random

$x = 2$ → number of success that is desired

$$= {}^{M}C_{n} \times {}^{N-M}C_{n-n}$$

$$= \frac{{}^{5}C_{2} \times {}^{10-5}C_{6-2}}{{}^{N}C_{n}}$$

$$= \frac{{}^{5}C_{2} \times {}^{10-5}C_{6-2}}{{}^{10}C_{6}}$$

$$= 5/21 \qquad = 0.2381$$

64) Applications of Chi-square

65) $7 \rightarrow 6/36$