(1)

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## SOLUTION

**Q1**

**a). Sachin bought 120 shares at market value of Rs. 375 each and brokerage 0.4%. Calculate the sum he paid for the transaction.** (5)

**Solution: -**

Market value of a share =Rs. 375
No. of shares he bought = 120.
He needs to pay sum= (375*120) =45,000
Brokerage=0.4%
Brokerage of 45000=45000*0.4/100=180
Total amount paid = sum +brokerage 45000+180=45180
Thus, sum he paid for the transaction is 45180.

**b). If the market value of a shares is Rs. 120, then How many shares can be purchased for Rs. 60,180 with brokerage 0.3%?** (5)

**Solutions: -**

Market value of a share =Rs. 120
Brokerage=0.3%
Brokerage of per share= 120*0.3/100=0.36
Cost of a share including brokerage = 120+0.36 =120.36 Rs
Total amount paid = Rs 60,180
No. of shares purchased =Total amount paid/cost of share including brokerage
= 60,180/120.36 =500

**c) Priya invested Rs. 20,000 in a mutual fund with NAV Rs 15.75. find the number of units acquired by her if,**
**i) There is no entry load ii) the entry load is 2%.** (5)

**Solution: -**

i. there is no entry load

she pays only 15.75 Rs per unit
thus, No. of units acquired by her = total amount invested/ NAV
=20,000/15.75
=1269.84

ii. the entry load is 2%.

Entry load per unit = 15.75*2/100 = 0.315
The actual price she has to pay per unit including entry load
=15.75+ 0.315 = 16.065
Thus, No. of units acquired by her =amount invested/price per unit
=20,000/16.065
= 1244.9424

**d) An investor sold 500 units of Mutual fund at NAV 230. Find the sale value when an exit load of 2% was applied.** (5)

**Solution: -**

(2)

Sale value= No of units x NAV – exit load

= 500x230 – 500x230x2%= 112700/-

**e) A person invested Rs. 6888 in a mutual fund and received 44.8 units. If the entry load is 2.5%, find the NAV at the time of purchase.** (5)

**Solution: -**

Let at the time of purchasing NAV of a unit = x Rs.
Entry load =2.5%
Total amount invested = 6888
Entry load per unit =$x$*2.5/100
Price per unit = ($x$ + $x$*2.5/100) = $x$(1+2.5/100)
He received 44.8 units then he has invested the amount
[44.8*(1.025)$x$] = 45.92$x$
Given that the investment is 6888 Rs.
Thus, 45.92$x$ = 6888
$x$ = 6888 /45.92 = 150.

**Q2.**

**a) A group contains 4 boys & 5 girls, out of these a committee of 2 boys and 3 girls is to be formed. Find the number of ways, this can be done if**

**i) There is no restriction on the selection.**

**ii) A particular boy is included.** (5)

Solution: -

**If there is no restriction on the selection then**

2 boys out of 4 boys can be selected in ${}^4C_2$ ways and 3 girls out of 5 girls can be selected in ${}^5C_3$ ways. Thus, required selection can be done in ${}^4C_2 * {}^5C_3 = 60$ ways.

**A particular boy is included in committee then**

We have to select only one boy, out of remaining 3 boys. This can be done in ${}^3C_1$ ways. 3 girls out of 5 girls can be selected in ${}^5C_3$ ways.
Thus, required selection can be done in ${}^3C_1 * {}^5C_3 = 30$ ways.

**b) In how many ways the letters of the word "COMPUTER" can be arranged so as to begin with a vowel& end with a consonant.** (5)

Solution: -

The word "COMPUTER" has 8 letters, of which 3 are vowels &
5 are consonants.
The 1st place can be filled using any of the 3 vowels in ${}^3P_1$ ways.
The last place can be filled using any of the 5 consonants in ${}^5P_1$ ways.
The remaining 6 places can be filled using from remaining 6 letters, vowels or consonants in ${}^6P_6$ ways. Thus, total no. of arrangements are ${}^3P_1 * {}^6P_6 * {}^5P_1 = 10800$ ways.

**c) Solve the given L. P. Problem graphically.** **(5)**

Solution: -

Draw the lines $2x+3y=18$ & $2x+y=10$ and obtain the feasible region say OAPBO. Where O, A, B are points (0,0), (5,0), & (0,6).
By solving these two questions. We get P is (x=3,y=4)

Check the value of $z=9x+13y$ at each corner point
At O(0,0) $z = 9*0+13*0 = 0$
AtA(5,0) $z = 9*5+13*0 = 45$
At P(3,4) $z = 9*3+13*4 = 79$
At B(0,6) $z = 9*0+13*6 = 78$
Thus, z is maximum at P(3,4). Optimal solution of LPP is $x = 3$ & $y=4$

**d) Solve the given L. P. Problem graphically.** **(5)**

Solution

Draw the lines $x+2y=6$ & $2x+y=6$ and obtain the feasible region say ABC.

Where, A is (0,6), Cis (6,0).

B is obtained by solving these two equations,
B is (x=2,y =2)
Check the value of $z=3x+2y$ at each corner point of the region then
At A(0,6), $z = 3*0+2*6 = 12$
At B(2,2), $z = 3*2+2*2 = 10$
At C(6,0), $z = 3*6+2*0 = 18$
Thus, z is minimum at A(0,6).
Optimal solution of LPP is $x = 0$& $y=6$

**e)**
**Formulate the given problem mathematically as a linear programming problem.**

Solution:-

| | Car (x) | Plane (y) | Max. hours available |
|---|---|---|---|
| machine A | 6 | 4 | 120 |
| machine B | 3 | 10 | 180 |

The Linear programming problem is
**Maximize $z = 45x+55y$ Subject to**

$$6x+4y \leq 120 \quad 3x+10y \leq 180, \; x \geq 0, y \geq 0$$

SECTION II

**Q3. Attempt any FOUR of the following:**

**a) State the merits and demerits of median.** **Theory** **(5)**

**b) Calculate the mean and mode for the following data.** **(5)**

| Age (years) | 20-25 | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | Total |
|---|---|---|---|---|---|---|---|
| No. of Persons | 10 | 15 | 33 | 22 | 10 | 10 | 100 |
| x | 22.5 | 27.5 | 32.5 | 37.5 | 42.5 | 47.5 | |
| fx | 225 | 412.5 | 1072.5 | 825 | 425 | 475 | 3435 |

(4)

Mean $\bar{X} = \frac{\sum fx}{N} = \frac{3435}{100} = 34.35$

Mode= $l + \frac{(fm - f_1)h}{2fm - f_1 - f_2}$ Where, fm= 33, $l$ =30, f1=15, f2 =22, $h$ =5

We put the values to get, Mode= $30 + \frac{(33-15)x5}{2x33-15-22} = 33.10$

**c) The following data represents the weights of students in a class. Calculate the quartile deviation for the same.** **(5)**

| Weights in kgs | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | |
|---|---|---|---|---|---|---|
| No. of students | 23 | 51 | 63 | 42 | 21 | 200 |
| cf (<) | 23 | 74 | 137 | 179 | 200 | |

Position of $Q_1$ = 200/4 = 50

$Q_1$ =40 +5.29412 =45.294

Position of $Q_3$ = 150

$Q_3$ = 60 + 3.09524 =63.095

QD = 8.9

**d) The following data gives the frequency distribution of marks of children in a society. Calculate the standard deviation for the given data.** **(5)**

| Marks | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | |
|---|---|---|---|---|---|---|
| No. of children | 5 | 8 | 17 | 7 | 3 | 40 |
| X | 5 | 15 | 25 | 35 | 45 | |
| Fx | 25 | 120 | 425 | 245 | 135 | 950 |
| fx*x | 125 | 1800 | 10625 | 8575 | 6075 | 27200 |

Mean of x = 23.75 SD = SQRT(115.938) = 10.7674

Mean $\bar{X} = \frac{\sum fx}{N} = \frac{950}{40} = 23.75$, S.D= $\sqrt{\frac{\sum fx^2}{N} - \bar{X}^2} = \sqrt{\frac{27200}{40} - 23.75^2} = 10.76$

**e)** Combine mean = (5000+ 12000)/ 300 = 17000/300 = 56.67
CV of FY Students= 4
CV of SY Students = 5
Marks of SY students are more variable

**Q.4 Attempt any FOUR of the following.**

**a) Theory** **(5)**

5

**b)** $P(A^C) = 2/3$ , $P(AUB) = 5/12$, $P(B) = 1/4$ , find $P(A)$ and $P(A \cap B)$ (5)

$P(A) = 1/3$ $P(A \cap B) = 0.16667$

**c)** Two cards are drawn from a well-shuffled pack of cards. What is the probability that (i) both are black cards (ii) one is a king card and the other is an ace card. (5)

$n(S) = {}^{52}C_2$

$P(\text{both are black cards}) = {}^{26}C_2/{}^{52}C_2$

$P(\text{one is a king card and the other is an ace card}) = 4*4/{}^{52}C_2$

**d)**

| Number | 0 | 1 | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|---|---|
| Probability | 0.2 | 0.25 | 0.2 | 0.15 | 0.1 | 0.1 | |
| x *P | 0 | 0.25 | 0.4 | 0.45 | 0.4 | 0.5 | 2.00 |

$E(X) = 2.00$

**e)** $n(S) = 36$ $P(\text{sum is multiple of 3}) = 12/36 = 1/3$

**Q5. Attempt any FOUR of the following:**

**a) Theory**

**b) Solve the following decision problem using i) Maximax ii) Laplace Criterion (5)** **(5)**

| Events → / Action ↓ | $S_1$ | $S_2$ | $S_3$ | Max | Average |
|---|---|---|---|---|---|
| $A_1$ | 20 | 15 | 23 | 23 | 19.3333 |
| $A_2$ | 25 | 10 | 30 | 30 | 21.6667 |
| $A_3$ | 35 | 25 | 20 | **35** | **26.6667** |

Best Decision by Maximax Criterion is $A_3$

Best Decision by Laplace Criterion is also $A_3$

**c)** Regret Table is

| State of Nature | | $S_1$ | $S_2$ | $S_3$ | EOL |
|---|---|---|---|---|---|
| Alternative | A | 10 | 6 | 10 | 9.2 |
| | B | 0 | 0 | 0 | 0 |
| | C | 7 | 10 | 15 | **10** |
| Probability | | 0.5 | 0.2 | 0.3 | |

Best Decision by EOL Criterion is Alternative B

**d) Given the pay-off matrix, choose the decision problem using EMV criterion. (5)**

| States of nature → Action ↓ | $S_1$ | $S_2$ | $S_3$ | EMV |
|---|---|---|---|---|
| $A_1$ | 25 | 12 | 15 | **18.8** |
| $A_2$ | 17 | 20 | 10 | 17.5 |
| $A_3$ | 15 | 10 | 13 | 12.8 |
| Probability(E) | 0.5 | 0.4 | 0.1 | |

Best Decision by EMV Criterion is Action $A_1$

**e) Draw a decision tree for the pay-off table given below (5)**

| | Sales (in '000 Rs.) | | | |
|---|---|---|---|---|
| Type of Product | High | Average | Low | EMV |
| Creamy biscuit | 20 | 30 | 50 | 31 |
| Salty biscuit | 30 | 25 | 35 | 28.5 |
| Probability(demand) | 0.3 | 0.5 | 0.2 | |

The best decision is to launch Cream biscuit using EMV criterion