STA 201

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Answer to the question no 1

(a)

To rent jet ski-

Given,

P(Jet skies) = 0.6 = p

P(canoes) = 1 − 0.6 = 0.4 = q

n = 20

$E(X) = n.p = 20 \times 0.6 = 12$

$\sigma(x) = \sqrt{n.p.q}$

$= \sqrt{20 \times 0.6 \times 0.4}$

$= 2.190$

Ans: $E(x) = 12$, $\sigma(x) = 2.19$

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(b)

As per the question,

$P(x > E(x) + 3\sigma)$ or $P(x < E(x) - 3\sigma)$

$\Rightarrow P(x > 12 + 3 * 2.190) + P(x < 12 - 3 * 2.190)$

$\Rightarrow P(x > 18.57) + P(x < 5.43)$

$\Rightarrow P(x \geq 18) + P(x < 5)$

$= (1 - P(x \leq 18)) + P(x < 5)$

$= (1 - 0.926) + 0.000$ [using Bionomial Probability table]

$= 0.074$ (Ans)

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(c)

As per the question,

$X \leq 10$

and, $20 - X \leq 15$

$\Rightarrow X \geq 5$

$P(5 \leq x \leq 10)$ [only the case where they can rent the water craft of their choice]

$= P(X=5) + P(x=6) + P(x=7) + P(x=8) + P(x=9) + P(x=10)$

$= P(X \leq 10) - P(X < 5)$

$= P(X \leq 10) - P(X \leq 4)$

$= 0.034 - 0$ [using Bionomial probability table]

$= 0.034$ (Ans)

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Answer to the question no 2

$X \sim N(\mu, \sigma^2)$

$X \sim N(180, 33^2)$

(a)

$P(X > 155)$

$\Rightarrow P\left(\frac{X-\mu}{\sigma} > \frac{155-180}{33}\right)$

$\Rightarrow P(Z > -0.75758)$

$= P(Z < 0.75758)$

$= 0.77756$ (Ans)

(b)

$P(Z < a) = 0.66$, $a = 0.41246$

$\therefore \frac{X-180}{33} = 0.41246$

$\Rightarrow X = 0.41246 * 33 + 180 = 193.611$

$\therefore$ 66th percentile $= 193.611$ (Ans)

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(c)

Probability of randomly selected swimmer will be eligible for the extended training program = S

$= P(167 < x < 193)$

∴ Probability of randomly selected swimmer will not be eligible for the extended training program = 1 − S

$= 1 - P(167 < x < 193)$

$= 1 - P\left(\frac{167-180}{33} < \frac{x-\mu}{\sigma} < \frac{193-180}{33}\right)$

$= 1 - P(-0.3939 < Z < 0.3939)$

$= 1 - (P(z < 0.3939) - P(z < -0.3939))$

$= 1 - (P(z < 0.3939) - 1 + P(z < 0.3939))$

$= 2 - 2P(z < 0.3939)$

$= 0.09365$ (Ans)

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(d)

$P(X \leq x) = 17.63\%$

$\Rightarrow P(X \leq x) = 0.1763$

Now

$\Rightarrow P\left(X \leq \frac{x-180}{33}\right) = 0.1763$

Using tables

$\frac{x-180}{33} = -0.92956$

$\Rightarrow x = 33 * (0.92956) + 180 \approx 149.32$ (Ans)

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Answer to the question no 3

(a)

Null Hypothesis (H_0): The mean yeild of the test variety is same as the given mean yeild.

$\therefore \mu = \mu_0 = 40$

Alternative Hypothesis (H_1): The mean yeild of test variety is not same of the given mean weight.

$\therefore \mu \neq \mu_1 = 40$

(b)

Type-I error = P (Rejecting H_0/H_0)

$= P(\bar{x} > K/H_0)$

$\bar{x} = 38$

$n = 50$

Means that the mean yeild of the test variety is same as the given mean weight but it's being rejected by us.

Type-II error = P (Accepting H_0/H_1)

Means that the mean yeild of the test is not same as the given mean weight but it's being still accepted by us.

(c)

Test hypotheses at 1% level of significance –

$$t_0 = \frac{\sqrt{n}\,(\bar{x} - \mu_0)}{\sigma} \sim N(0,1)$$

$$= \frac{\sqrt{50}\,(38-40)}{4.5} = -3.142$$

Here,

$Z_t = 2.58$, $\alpha = 0.01$

$n = 50$, $\bar{x} = 38$, $\mu_0 = 40$

$\sigma = 4.5$

$\therefore Z_t < |t_0|$. So, we reject the null hypothesis H_0 and claim that the the mean yield of the test variety is not equals to 40 kg/ha.

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Answer to the question 4

(a)

Null hypothesis:

Airport should not be designated as superior service;-

$$H_0: \mu \leq 17$$

Alternative hypothesis:

Airport should be designated as superior service:

$$H_1: \mu > 17$$

(b)

Given data: 6, 17, 8, 6.5, 8.5, 17, 17.5, 9, 8.2, 6, 8.8, 7.2, 7.6, 9.5, 8.4

and $n = 15$

$\therefore$ Mean, $\bar{X} = \frac{\sum x_i}{n} = \frac{115.2}{15} = 7.68$ (Ans)

x_i	6	17	8	6.5	8.5	17	17.5	9	8.2	6	8.8	7.2	7.6	9.5	8.4
$\bar{x}$	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68
$x_i - \bar{x}$	-1.68	0.68	0.32	-1.18	0.82	-0.68	0.18	1.32	0.52	-1.68	1.12	-0.48	-0.08	1.82	0.72
$(x_i - \bar{x})^2$	2.82	0.46	0.10	1.39	0.67	0.46	0.03	1.74	0.27	2.82	1.25	0.23	0.01	3.31	0.52

$\therefore \sum (x_i - \bar{x})^2 = 16.104$ $\therefore$ SD, $\sigma = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$

$= \sqrt{\frac{16.104}{14}} = 1.0726$ (Ans)

(c)

Known,

$$t_{calc} = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$$= \frac{17.68 - 17}{1.0725/\sqrt{15}}$$

$$= 2.454$$

Given,

$\alpha = 5\% = 0.05$

$\mu = 17$

$\bar{x} = 17.68$ [from b]

$\sigma = 1.0725$ [from b]

$n = 15$

degree of freedom, $n-1 = 15-1 = 14$,

the tabulated value at 5% level of significance is 1.761.

Since, $t_{calc} = 2.454 > t = 1.761$, falls in the critical region; we are rejecting the null hypothesis and accepting the alternatives.

Thus, the airport should be designated as a suburban service.