Final Assignment

Probability and Statistics

Section 4

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North South University

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Final Assignment

1| The pentagon consists of five triangles.

If we spun the spinner the every number (1, 2, 3, 4, 5) or side have the probability of $\frac{1}{5}$ to get the side or number. So, the probability of getting any side of number is $p = \frac{1}{5}$

The spinner spun. 5 times $(n = 5)$

We have to calculate the probability of getting at most two 5's.

In here we are following the binomial distribution.

So, the probability of getting at most two 5's

$$P(X \leq 2) = P(X=0) + P(X=1) + P(X=2)$$

$$= \binom{5}{0}\left(\frac{1}{5}\right)^0\left(1-\frac{1}{5}\right)^{5-0} + \binom{5}{1}\left(\frac{1}{5}\right)^1\left(1-\frac{1}{5}\right)^{5-1} + \binom{5}{2}\left(\frac{1}{5}\right)^2\left(1-\frac{1}{5}\right)^{5-2}$$

$$= 0.3277 + 0.4096 + 0.2048$$

$$= 0.9421$$ Answer

2) Given, an average of 5 failures ~~a~~ every year.
As it is measured in a time interval, it ~~is~~ follows Poisson distribution. probability, $P(X=x) = \frac{e^{-\lambda}(\lambda)^x}{x!}$
here, $E(x) = \lambda_y = 5$
Probability that there will be more than one failure during a particular week, $P(X>1)$

1 year = 365 days
1 week = 7 days
$\therefore$ 1 year $= \frac{365}{7}$ weeks
$= 52.143$ weeks

For particular week,
$$\lambda_w = \frac{5}{52.143}$$
$$= 0.0959$$

$$P(X>1) = P(X=2) + P(X=3) + \cdots$$
$$= 1 - P(X=0) - P(X=1)$$
$$= 1 - \frac{e^{-0.0959}(0.0959)^0}{0!} - \frac{e^{-0.0959}(0.0959)^1}{1!}$$
$$= 1 - 0.90855 - 0.0871$$
$$= 4.3196 \times 10^{-3}$$
$$= 0.00432$$ Answer

3) Given, Normally distributed,

mean, $E(x) = \mu = 185$ cm

varience, $V(x) = \sigma^2 = 2$ cm^2

$\therefore \sigma = \sqrt{2}$

To calculate the probability that a adult people height is greater than 184 cm,

$P(x > 184)$

$= P(184 < x < \infty)$

$= P\left(\frac{184-\mu}{\sigma} < \frac{x-\mu}{\sigma} < \frac{\infty-\mu}{\sigma}\right)$

$= P\left(\frac{184-185}{\sqrt{2}} < z < \infty\right)$

$= P(-0.707 < z < \infty)$

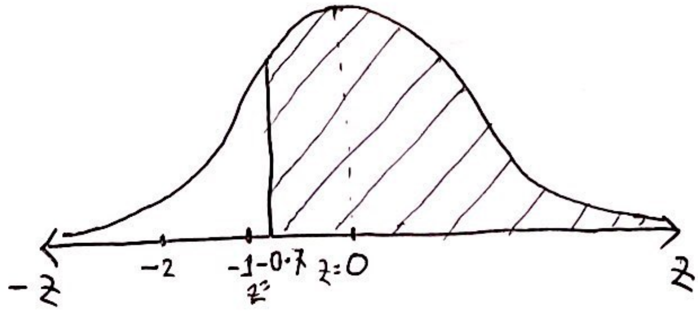
$= F(\infty) - F(-0.707)$

$= 1 - F(-0.71)$

$= 1 - 0.2389$

$= 0.7611$ Answer

sketch



4 :

$H_0 : \mu = 70$

$H_1 : \mu < 70$

Test statistic is $\dfrac{\bar{X} - \mu_0}{\sqrt{\frac{s^2}{n}}} \sim t_{(n-1)}$

$$\bar{X} = \frac{60+75+72+65+68}{5}$$

$\therefore \bar{X} = 68$

$\mu_0 = 70$

$n = 5$

$$s^2 = \frac{\Sigma (x_i - \bar{x})^2}{n-1}$$

$$= \frac{(60-68)^2 + (75-68)^2 + (72-68)^2 + (65-68)^2 + (68-68)^2}{5-1}$$

$$= \frac{69}{2}$$

$$= 34.5$$

$\therefore s = \sqrt{34.5} = 5.8737$

$\therefore$ Test statistic is $\dfrac{68-70}{\sqrt{\frac{34.5}{5}}}$

$$= \frac{-2}{\frac{5.8737}{\sqrt{5}}}$$

$$= -0.76$$

The rejection region is $]-\infty, -t_\alpha]$

$=]-\infty, -t_{0.05}]$

$=]-\infty, -2.132]$

$\alpha = 5\%$
$= 0.05$

Degree of freedom
$\upsilon = 5 - 1 = 4$

Comment: Since test statistics value (-0.76) doesn't fall in rejection region, so we cannot reject null hypothesis (H_0).

The researcher's assumption about testing the mean weight of adult men in Bangladesh is incorrect.

5| Here, blood sample of 5 people (same) were sent to each of two laboratories (lab1 and lab2) for cholesterol determinations.

Though same blood sample of 5 people sent to each of two lab, it is matched paired t test. From the data we get significant mean difference between two sets of ~~data~~. paired data.

$H_0 : \mu_D = 0$ and $H_1 : \mu_D < 0$

$\because \mu_x > \mu_y$

$\therefore \mu_y - \mu_x < 0$

where $\mu_D = \mu_y - \mu_x$

μ_x indicates mean cholesterol levels reported by lab1.

μ_y indicates mean cholesterol levels reported by lab2.

Test static $= \dfrac{\bar{D}}{\sqrt{\frac{s_D^2}{n}}} \sim t_{n-1}$

From the data we get,

Person (i)	$D_i = Y_i - X_i$
1	$318-276 = 42$
2	$287-270 = 17$
3	$285-265 = 20$
4	$-300+262 = -38$
5	$-280+296 = 16$

$\therefore$ sample mean difference, $\bar{D} = \dfrac{42+17+20-38+16}{5}$

$= \dfrac{57}{5} = 11.4.$

$$S_D^2 = \frac{\sum_{i=1}^{5} (D_i - \bar{D})^2}{n-1}$$

$$= \frac{(42-11.4)^2 + (17-11.4)^2 + (20-11.4)^2 + (-38-11.4)^2 + (16-11.4)^2}{5-1}$$

$$= \frac{3503.2}{4}$$

$$= 875.8$$

$\therefore$ Test statistics $= \dfrac{11.4}{\sqrt{\dfrac{875.8}{5}}}$

$$= \frac{11.4}{13.235}$$

$$= 0.8614$$

$\alpha = 10\% = 0.1$ and degree of freedom, $\nu = 5-1 = 4$

Rejection region : $]-\infty, -t_{\alpha, n-1}]$

$=]-\infty, -t_{0.1,4}]$

$=]-\infty, -1.533]$

<u>Comment</u>: Since the calculated value (0.861) does not fall in the rejection region. We cannot reject null hypothesis (H_0)

So, the assumption about the (population) mean cholesterol levels reported by lab 1 ~~and~~ and the (population) mean cholestevol levels reported by lab 2 is incorrect. The mean cholestevol levels reported by lab1 is not greater than the mean cholesterol levels reported by lab 2.