Declaration :

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| 3) B.E / M.Tech / MCA | B.E |
| 4) Semester | 3 |
| 5) Course Name | Statistical - Numerical - Fourier Techniques |
| 6) Course Code | 18 MATCS 31 |
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| I hereby declare the above mentioned info is true to best of my knowledge. Also I agree to abide all the regulations for online exams framed by the college. | |
| 10) Signature | |

# PART - A

1.) $n-(p+q)$

2.) True

3.) $F'(x) = \dfrac{f(x)}{x_n - x_{n+1}}$

4.) Because there are $\infty$ no. of possibilities for $\mu$ & $\sigma$

5.) ~~P(E) ≤ 1 ≥ 0~~

Probability of success (p) & failure (q) $= p+q$
$= 1$

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# PART-B

7.)

(a) By data.

i)* $P(x < 45) = 31\%$

WKT $z = \frac{x-\mu}{\sigma} \rightarrow z = \frac{45-\mu}{\sigma}$ ($z_1$, say)

$P(x<45) = 0.31$

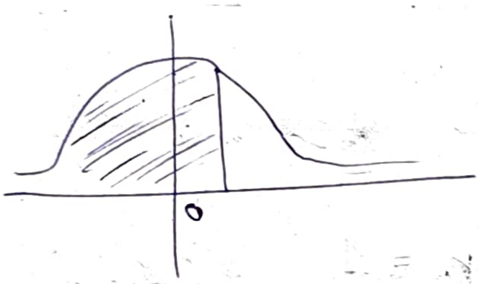
2)* $P(64<x) = 8\%$

$P(64<x) = 0.08$

WKT $z = \frac{x-\mu}{\sigma} \rightarrow z = \frac{64-\mu}{\sigma}$ ($z_2$, say)

$P(64<x) = 0.8$

i)




$0.5 + \phi(z_1) = 0.31$

$\phi(z_1) = 0.31 - 0.5$

$\boxed{\phi(z_1) = -0.19}$

2)

$0.5 - \phi(z_2) = 0.08$

$\phi(z_2) = 0.42$

Reflecting to normal probability, we have.

$\phi(z_1) = -\phi(0.5)$ & $\phi(z_2) = \cancel{0.} 0.42$

$\cancel{z_1} = \cancel{1.049}$

$\boxed{z_2 = 1.44}$

$\boxed{z_1 = -0.5}$

7.)

$Z_1 = \frac{x-\mu}{\sigma}$ ; $Z_2 = \frac{x-\mu}{\sigma}$

$Z_1 = \frac{45-\mu}{\sigma}$ ; $Z_2 = \frac{64-\mu}{\sigma}$

$-0.5\sigma = 45-\mu \rightarrow (1)$ ; $1.4\sigma = 64-\mu \rightarrow (2)$

On solving (1) & (2)

we get $\boxed{\sigma = 10}$ & $\boxed{\mu = 50}$

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5.)

i.) WKT, $\sum_i P(x) = 1$

$\therefore$ By Given table :

$\sum_i P(x) = 1$

$k + 2k + 2k + 3k + k^2 + 2k^2 + 7k^2 + k = 1$

$10k^2 + 9k - 1 = 0$

$k = \frac{1}{10}$ or $k = -1$

$\boxed{k = \frac{1}{10}}$

ii.) $P(x<3) = P(x=0) + P(x=1) + P(x=2)$

$= 0 + k + 2k$

$= 3k$

$\boxed{P(x<3) = \frac{3}{10} \text{ or } 0.3}$

iii) $P(x \geq 6) = P(x=6) + P(x=7)$

$$= 2K^2 + 7K^2 + K$$

$$= 9K^2 + K$$

$$= \frac{9}{100} + \frac{1}{10}$$

$$\boxed{P(x \geq 6) = \frac{19}{100} \text{ or } 0.19}$$

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6) $P(\text{shot before target}) = \frac{10}{100} = 0.1$

$P(\text{At least 4 out of 5 get shot}) = P(4\text{ shot}) + P(5\text{ shot})$

$p = \text{success} = \frac{1}{10}$

$q = \text{failure} = \frac{9}{10}$

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

$\therefore P(\text{At least 4 out of 5 get shot}) = {}^5C_4 \left(\frac{1}{10}\right)^4 \left(\frac{9}{10}\right) + {}^5C_5 \left(\frac{1}{10}\right)^5$

$$= \frac{45}{10^5} + \frac{1}{10^5}$$

$$= 4.6 \left(\frac{1}{10^4}\right)$$

$$= 4.6 \times 10^{-4}$$

1.) $f(x) = x^2 - 5x + 2 = 0$

Root lies in b/w 4 & 5

WKT $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$

~~Let $x_0$~~

Limit from (+ve) 0 —— 1 (-ve)

(or) (-ve) 4 —— 5 (+ve)

Let $x_0 = 4$.

$f(x) = x^2 - 5x + 2$ & $f'(x) = 2x - 5$

$f(4) = 2$, $f(5) = -2$

$\rightarrow x_1 = 4 - \frac{2}{(-5)} = 4.4$

$\rightarrow x_2 = 4.4 - \frac{(4.4)^2 - 5(4.4) + 2}{2(4.4) - 5} = 4.2315$

$\rightarrow x_3 = 4.2315 - \frac{(4.2315)^2 - 5(4.2315) + 2}{2(4.2315) - 5} = 4.5930$

$\rightarrow x_4 = 4.5930 - \frac{(4.5930)^2 - 5(4.5930) + 2}{2(4.5930) - 5} = 4.5587$

$\rightarrow x_5 = 4.5587 - \frac{(4.5587)^2 - 5(4.5587) + 2}{2(4.5587) - 5} = 4.5615$

$\rightarrow x_6 = 4.5615 - \frac{(4.5615)^2 - 5(4.5615) + 2}{2(4.5615) - 5} = 4.56158$

$\therefore$ $\boxed{\text{Real Root} = 4.56158}$

2) $f(x) = 2x - \log_{10} x - 7 = 0$

$2x = \log_{10} x + 7$

$x = \dfrac{\log_{10} x + 7}{2} = \phi(x)$

$\phi'(x) = \dfrac{1}{2}\left(\dfrac{1}{x}\right) = \dfrac{1}{2x} \quad \left(\because \phi(x) = \dfrac{\log_{10} x + 7}{2}\right)$

Consider $f(x) = 2x - \log_{10} x - 7$

Root lies in interval $(3.7, 3.8)$

$f(3.7) = -0.1682$

$f(3.8) = 0.0202$

$\because |\phi'(3.7)| = 0.1351 < 1$

& $|\phi'(3.8)| = 0.1315 < 1$

Let $x_0 = 3.7$ be initial approximate

$x_1 = \phi(x_0) = \dfrac{\log_{10}(x_0) + 7}{2} = \dfrac{\log_{10}(3.7) + 7}{2} = 3.7841$

$x_2 = \phi(x_1) = \dfrac{\log_{10}(x_1) + 7}{2} = \dfrac{\log(3.7841) + 7}{2} = 3.7889$

III$^{ly}$ $x_3 = \phi(x_2) = \dfrac{\log(3.7889) + 7}{2} = 3.7892$

$x_4 = \phi(x_3) = \dfrac{\log(3.7892) + 7}{2} = 3.7892$

$\boxed{\therefore x = 3.7892}$ is the approx value of required root.

3.) Given:

$y' = x - y^2$ , $y_0 = 1$ , $x_0 = 0$

$$y(x) = y_0 + \frac{(x-x_0)}{1!}y'_0 + \frac{(x-x_0)^2}{2!}y''_0 + \frac{(x-x_0)^3}{3!}y'''_0 + \dots$$

We have,

* $y' = x - y^2$ ; $y'(0) = 0 - 1^2 = -1$
* $y'' = 1 - 2yy'$ ; $y''(0) = 1 - 2(1)(-1) = 1 + 2 = 3$
* $y''' = -2[yy'' + (y')^2]$ ; $y'''(0) = -2[3 + 1] = -8$

$$\therefore y(0.1) = y_0 + \frac{(0.1-0)}{1}y'_0 + \frac{(0.1)^2}{2!}y''_0 + \frac{(0.1)^2}{3!}y'''_0 + \dots$$

$$= 1 + 0.1(-1) + \frac{(0.1)^2}{2}(3) + \frac{(0.1)^2}{6}(-8) + \dots$$

$$= 1 - 0.1 + 0.015 - 0.001 + \dots$$

$$\boxed{y(0.1) = 0.91366}$$