Assignment-1

CS21B061
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Ques) Given, $f(x) = (x-1)(x-2)(x-3)(x-4)(x-5)$

simplifying $f(x)$, we get:

$$f'(x) = 5x^4 - 60x^3 + 255x^2 - 450x + 274$$

now, a/c to Newton-Raphson ~~minimization~~ root finding :-

$$x^{new} = x^{old} - \left.\frac{f(x)}{f'(x)}\right|_{x^{old}}$$

Let $x_0 = 1.5$

$$\Rightarrow f'(x)|_{x^{old}} = f'(1.5)$$

$$= 5\left(\frac{3}{2}\right)^4 - 60\left(\frac{3}{2}\right)^3 + 255\left(\frac{3}{2}\right)^2 - 450\left(\frac{3}{2}\right) + 274$$

$$= -4.4375$$

& $f(x)|_{old} = f(1.5) = (0.5)(-0.5)(-1.5)(-2.5)(-3.5)$

$$= 3.28125$$

$$x_1 = 1.5 - \frac{3.28125}{-4.4375} = 1.5 + 0.73943$$

$$= 2.239443 \quad \text{—— (i)}$$

$\Rightarrow f(x)|_{x_1} = -1.09696$ & $f'(x)|_{x_1} = -3.00388$

$$x_2 = 2.23943 - \frac{-1.09696}{-3.00388} = 1.87424 \quad \text{— (ii)}$$

$\Rightarrow f(x)|_{x_2} = 0.82241$; $f(x)|_{x_2} = -6.97934$

$$x_3 = 1.87424 - \frac{0.82241}{-6.97934}$$

$$x_3 = 1.99217 \quad \text{— (iii)}$$

As we can see from (i), (ii) & (iii), the values are converging towards 2.

Thus, $\underline{2}$ is the root of $f(x)$.