

Exercise # 9.2

Polynomial Regression

Question - 01

$$P(u) = u^3 + 2u^2 + u - 3$$

observed value =

$$5\text{th month} = u + 5$$

$$\text{Predicted value} = 240$$

Put $u = 5$ in $f(u)$

$$P(5) = (5)^3 + 2(5)^2 + (5) - 3$$

$$= 125 + 2(25) + 5 - 3$$

$$= 125 + 50 + 2$$

$$P(5) = 177$$

Error:

$$\text{Error} = 240 - 177$$

$$= 63$$

$$\text{Percentage} = \frac{63}{240} \times 100\%$$

$$\boxed{\% \text{age} = 26\%}$$

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Question - 02:

$$D(w) = w^3 - 2w^2 + 5w - 4$$

observed value

$$3\text{th week} = u + 3$$

$$\text{Predicted value} = 22$$

Put $u = 3$ in $D(w)$

$$D(w) = 4(3)^3 - 2(3)^2 + 5(3) - 4$$

$$= 27 - 2(9) + 15 - 4$$

$$= 27 - 18 + 15 - 4$$

$$= 42 - 22$$

$$= 20$$

$$\text{Error} = 22 - 20 = 2$$

20 unit, 2 unit

Ans.

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Question - 03:

Transfer function:

Define:

These transfer function are rational functions, meaning they are ratio of two polynomials in z.i.e, $H(z) = \frac{B(z)}{A(z)}$, where $B(z)$ represent the numerator polynomial and $A(z)$ represent the denominator polynomial.

Formula:

$$H(z) = \frac{B(z)}{A(z)}$$

Zeros:

$$\text{Numerator} = 0$$

$$\text{Poles} = \text{Denominator} = 0$$

Q = 03

$$B(z) = z^2 - 2z - 2$$

By factor theorem to find zeros we

$$\text{Put numerator} = 0$$

$$B(z) = 0$$

$$z^2 - 2z - 2 = 0$$

Date: _____

$$z^2 - 2z - z - 2 = 0$$

$$z(z+2) - 1(z+2) = 0$$

$$(z-1)(z+2) = 0$$

$$z-1=0 \quad | \quad z+2=0$$

$$\boxed{z=1} \quad | \quad \boxed{z=-2}$$

$$S.S = \{1, -2\}$$

Question - 05

$$H(z) = \frac{z^2 - 0.5z - 0.5}{z^3 + 1}$$

By factor to the find zeros we

Put numerator = 0

$$z^2 - 0.5z - 0.5$$

$$a=1, b=-0.5, c=-0.5$$

$$z = \frac{-(-0.5) \pm \sqrt{(-0.5)^2 - 4(1)(-0.5)}}{2(1)}$$

$$2(1)$$

$$= \frac{0.5 \pm \sqrt{0.25 + 2}}{2}$$

$$2$$

$$= \frac{0.5 \pm \sqrt{2.25}}{2}$$

$$2$$

$$= \frac{0.5 \pm 1.5}{2}$$

$$2$$

$$\frac{0.5 + 1.5}{2}, \frac{0.5 - 1.5}{2}$$

$$z = 2, z = -1/2$$

Question - 06

$$A(z) = z^2 - 0.3z - 0.4$$

By factor theorem to the find we put

$$\text{Denominator} = 0$$

$$A(z) = 0$$

$$z^2 + 0.3z - 0.4 = 0$$

$$a = 1, b = 0.3z, c = -0.4$$

$$z = \frac{-(-0.3) \pm \sqrt{(-0.3)^2 - 4(1)(-0.4)}}{2(1)}$$

$$z = \frac{0.3 \pm \sqrt{0.09 + 1.6}}{2}$$

$$z = \frac{0.3 \pm \sqrt{1.69}}{2}$$

$$z = \frac{0.3 \pm 1.3}{2}$$

$$z = \frac{0.3 + 1.3}{2}, \frac{0.3 - 1.3}{2}$$

$$z = 0.8, z = -0.5$$

Question-07

$$P(z) = z^2 + 1.2z + 0.35$$

By factor theorem to find poles we put

$$\text{Denominator} = 0$$

$$A(z) = 0$$

$$z^2 + 1.2z + 0.35 = 0$$

$$a = 1, b = 1.2, c = 0.35$$

$$z = \frac{-(-1.2) \pm \sqrt{(1.2)^2 - 4(1)(0.35)}}{2(1)}$$

$$z = \frac{-1.2 \pm \sqrt{1.44 - 1.4}}{2}$$

$$z = \frac{-1.2 \pm \sqrt{0.04}}{2}$$

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$$z = \frac{-1.2 \pm 0.2}{2}$$

$$z = \frac{-1.2 + 0.2}{2}, \quad z = \frac{-1.2 - 0.2}{2}$$

$$z = -\frac{1}{2}, \quad z = -\frac{1.4}{2}$$

$$z = -0.7$$