AI1110
Assignment-3

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Outline

Question

Papoullis 4-10:

If x is $N(0,2)$ find (a) $P\{1 \leq x \leq 2\} and (b) P\{1 \leq X \leq 2 | x \geq 1\}$

Definitions

x is $N(\mu, \sigma^2)$ *willbeusedtorepresenttheGaussianp.d.f*

Normal(Guassian) Distribution Function

If $f_X(x)$ is probability density function of a random variable X, then it's corresponding distribution function $F_X(x)$ is

$$F_X(x) = \int_{-\infty}^{x} \frac{1}{\sqrt{2\pi}} e^{\frac{-(y-\mu)^2}{2\sigma^2}} dy \qquad = G(\frac{x-\mu}{\sigma}) \qquad (1)$$

Solution

From the given information; $N(0,2)$
so,

$$\mu = 0$$

,

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

(a)

$$
\begin{aligned}
P\{1 \le x \le 2\} &= P\{x \le 2\} - P\{x \le 1\} && (2)\\
&= F_x(2) - F_x(1) && (3)\\
&= G\left(\frac{2-\mu}{\sigma}\right) - G\left(\frac{1-\mu}{\sigma}\right) && (4)\\
&= G\left(\frac{2-0}{\sqrt{2}}\right) - G\left(\frac{1-0}{\sqrt{2}}\right) && (5)\\
&= \int_{-}^{\sqrt{2}} \frac{1}{\sqrt{2\pi}} e^{\frac{-y^2}{2}}\, dy - \int_{-}^{\frac{1}{\sqrt{2}}} \frac{1}{\sqrt{2\pi}} e^{\frac{-y^2}{2}}\, dy && (6)\\
&= 0.41924 - 0.25804 && (7)\\
&= 0.1612 && (8)\\
& && (9)
\end{aligned}
$$

(b)

$$P\{1 \leq X \leq 2 | x \geq 1\} = \frac{P\{1 \leq x \leq 2\}}{P\{x \geq 1\}} \tag{10}$$

$$= \frac{P\{x \leq 2\} - P\{x \leq 1\}}{P\{x \geq 1\}} \tag{11}$$

$$= \frac{F_x(2) - F_x(1)}{1 - F_x(1)} \tag{12}$$

$$= \frac{G(\frac{2-0}{\sqrt{2}}) - G(\frac{1-0}{\sqrt{2}})}{1 - G(\frac{1-0}{\sqrt{2}})} \tag{13}$$

$$= \frac{0.41924 - 0.25804}{1 - 0.75804} \tag{14}$$

$$= 0.67 \tag{15}$$