

AI1103 : Assignment 5

Raja Ravi Kiran Reddy - CS20BTECH11009

Download all python codes from

<https://github.com/BokkaRajaRaviKiranReddy/AI1103/tree/main/Assignment5/codes>

and latex codes from

<https://github.com/BokkaRajaRaviKiranReddy/AI1103/blob/main/Assignment5/Assignment5.tex>

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Activities A,B,C,D from the critical path for a project with a PERT network. The means and variances of the activity duration for each activity are given below. All activity durations follow the Gaussian (normal) distribution, and are independent of each other.

Activity	A	B	C	D
Mean	6	11	8	15
variance	4	9	4	9

The probability that the project will be completed within 40 days is
(round off to two decimal places)
(Note: Probability is a number between 0 and 1)

SOLUTION

Activity	A	B	C	D
μ	6	11	8	15
σ	4	9	4	9

$E = A + B + C + D$

The sum of Gaussian distributions will also give Gaussian distribution.
mean of $E = \mu_E$,

$$\begin{aligned}\mu_E &= \mu_A + \mu_B + \mu_C + \mu_D \\ &= 40\end{aligned}$$

Standard deviation of $E = \sigma_E$,

$$\begin{aligned}\sigma_E^2 &= \sigma_A^2 + \sigma_B^2 + \sigma_C^2 + \sigma_D^2 \\ \sigma_E &= 5.1\end{aligned}$$

$$f(x) = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{1}{2} \left(\frac{x-\mu}{\sigma} \right)^2}$$

$$f_E(x) = \frac{1}{5.1 \sqrt{2\pi}} e^{-\frac{1}{2} \left(\frac{x-40}{5.1} \right)^2} \quad (18.1)$$

For a Gaussian Distribution,

$$\begin{aligned}\int_{-\infty}^{\mu} f(x) dx &= \int_{\mu}^{+\infty} f(x) dx \\ \int_{-\infty}^{+\infty} f(x) dx &= 1\end{aligned}$$

$$\Rightarrow \int_{-\infty}^{\mu} f(x) dx = \frac{1}{2} \quad (18.2)$$

Consider Eq 18.1, we want $\Pr(x \leq 40)$

$$\Pr(x \leq 40) = \int_{-\infty}^{40} f_E(x) dx$$

For activity E, $\mu_E = 40$. So From eq 18.2,

$$\begin{aligned}\int_{-\infty}^{40} f_E(x) dx &= \frac{1}{2} \\ \Rightarrow \Pr(x \leq 40) &= 0.50\end{aligned}$$

