

# Simulation of Erection of Site

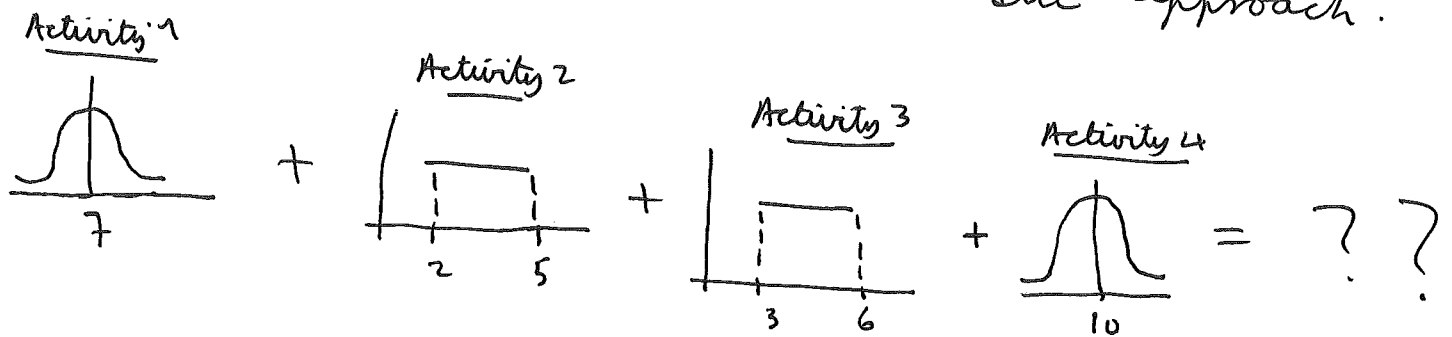
## Offices at a Construction Site

1. Clear site      Normal ( $\mu = 7$  days,  $\sigma = 2$  days)
2. Supply and erect trailers      Uniform ( $\alpha = 2$ ,  $\beta = 5$ )
3. Instal furnishing, <sup>toilets,</sup> equipment, etc      Uniform ( $\alpha = 3$ ,  $\beta = 6$ )
4. Hook up power, water, telephones      Normal ( $\mu = 10$ ,  $\sigma = 6$ )

If we went by the 'average' times for each activity

$$\text{Project duration} = 7 + \frac{5+2}{2} + \frac{6+3}{2} + 10 = 25 \text{ days.}$$

However we could have a probabilistic approach.



So we pull random  $F$  values and determine the corresponding value of the random variable ( $x$ ), for each input distribution

Simulation 1:

Activity 1: random  $F = 0.7289$ ,  $\rightarrow$   $z\text{-score} = 0.61$   $\xrightarrow{z = \frac{x - \mu}{\sigma}}$   $X = 8.22 \text{ days}$

Activity 2: random  $F = 0.4500$   $\rightarrow$   $\frac{1}{3}$   $\rightarrow$   $0.33(x') = 0.450$   $\Rightarrow x' = 1.36$   $X = 2 + 1.36 = 3.36 \text{ days}$

Activity 3: random  $F = 0.01$   $\rightarrow$   $0.33 x' = 0.01 \Rightarrow x' = 0.30 \rightarrow X = 3.30 \text{ days}$

Activity 4: random  $F = 0.2975$   $\rightarrow$   $z\text{-score} = -0.53$   $\rightarrow$   $X = 6.82 \text{ days}$

21.7 days

Simulation 2 :

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Simulation n :

After n simulations we have synthesized data of the project duration from the input distributions. This is the famous MONTE CARLO SIMULATION method. Please note there are other simulation techniques, for example Latin Hypercube simulation.

So now with the synthesized data we can determine say the 95th percentile for project completion. (See spreadsheet).

95th percentile: 34.5 days

Mean : 24.3 days

So if we are to solicit bids from contractors we know that any bid requesting say 40 days for the work is too much. A bid coming below 24 may be considered too optimistic, and the contractor may not be able to deliver.

If I was the administrator of this project I would accept any bid between these two. If I was a contractor in a tough volatile market, I would base my estimate on 34.5 days but would tell the developer I will finish in 24 days.