Construction Project completion Management

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Motivation:

Construction project's quality relies on two different aspect, first is the implementation quality, the other is the completion duration. The ability of a management company to evaluate the possible completion duration as well as hazardous for project is necessary. Generally, the expense is dependent on the duration, so the sooner to complete the project the less expense will be costed.

Hazardous Identification:

Usually the hazardous for project are technique issues, worker healthy problem, safety issues, and so on. Different hazardous issues will have different probability, upon these probabilities, hazardous can be clarified in different levels. Highest levels hazardous will have the most negative impact on project completion date. For example for safety issues usually will drag the project to extend for up to many years，occupation injury is normal, but also need to be considered within the project.

Case Study:

For a complete project, usually contains several steps. Part A may take 40 days to complete, the this project will be past to next contractor to do part B, then so on. Hazardous risks exist in every part and every steps in the project. So evaluate these factors and the completion date will be most helpful for client to understand the overall process, and make reasonable budget plan.

The table listed below is the example I made, to illustrate the overall project. From the sequential steps, A, B, C are three independent beginning steps. The rest of the steps will follow these three parts. Usually every step will have its own duration with slack up to 9 days (depends the most hazardous risk in the project).

The overall completion date will be the summation of these terms. Simulation will be the most helpful tool to help us understand what is happening in the project risk evaluation. So I use R code to simulate the result, by applying Monte-Carlo method. The project manager will pick up the most probable completion duration to report to client and help them to make budget plan.

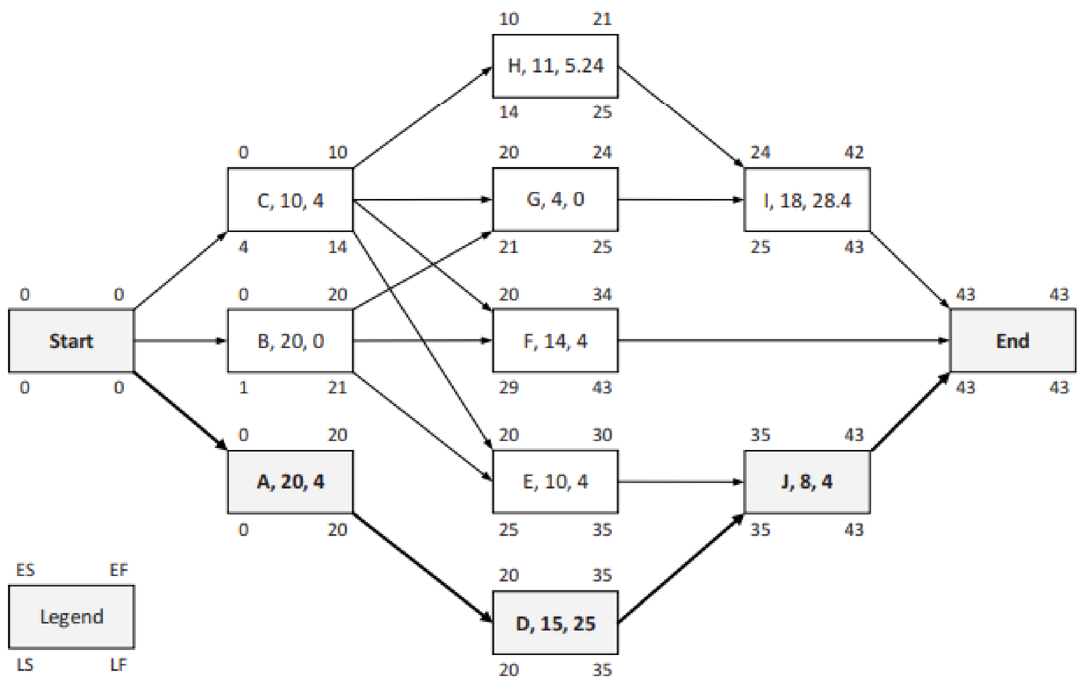
ID	Activity name	Predecessor ID	Optimistic duration (a)	Most likely duration (m)	Pessimistic duration (b)	Expected duration (TE)	Variance (σ^2)	Total slack
1	A	-	10	22	22	20	4	0
2	B	-	20	20	20	20	0	1
3	C	-	4	10	16	10	4	4
4	D	1	2	14	32	15	25	0
5	E	2;3	8	8	20	10	4	5
6	F	3;2	8	14	20	14	4	9
7	G	2;3	4	4	4	4	0	1
8	H	3	2	12	16	11	5.4	4
9	I	8;7	6	16	38	18	28.4	1
10	J	4;5	2	8	14	8	4	0

The expected duration:

$$TE = (a + 4m + b)/6$$

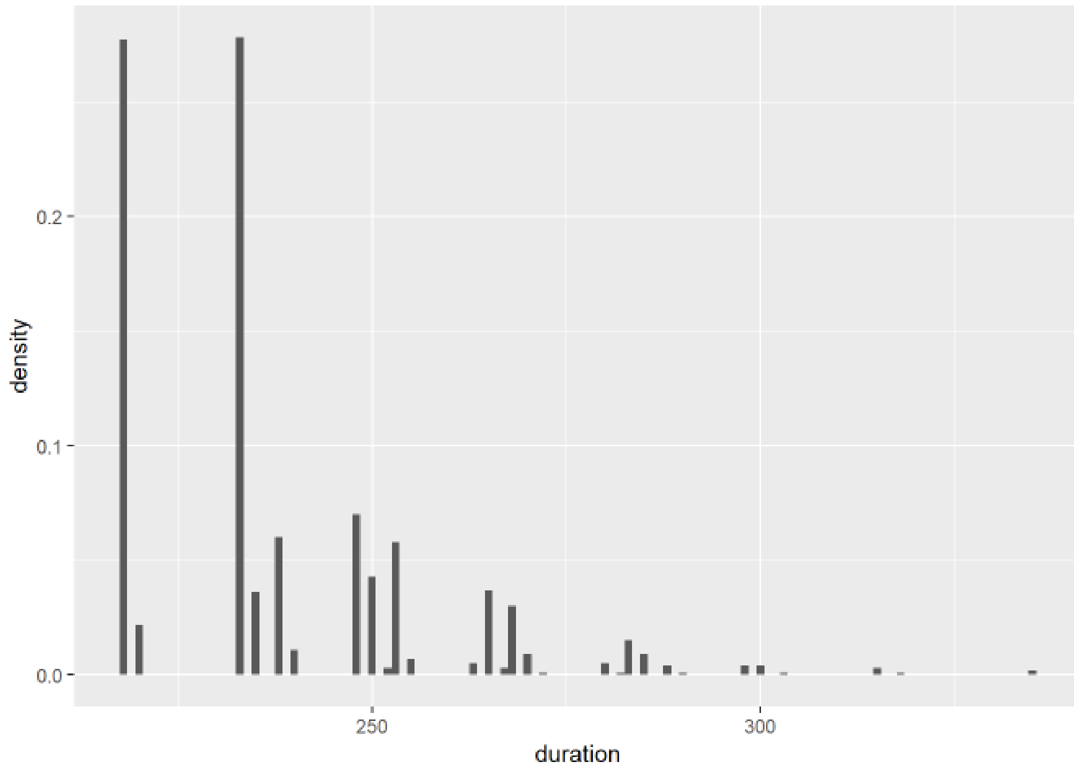
The variance:

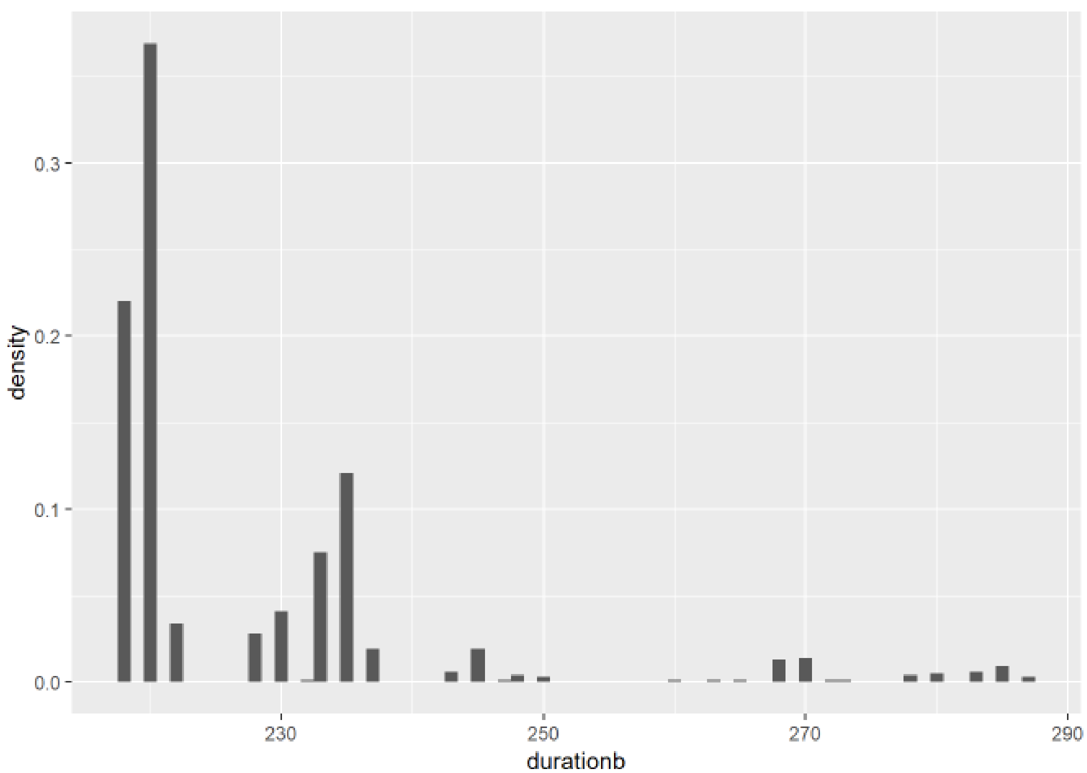
$$\sigma^2 = ((b - a)/6)^2$$



From simulation we got:
The expected durations are obtained from 1000 simulations by implementing different risk factors and their probability. From these two graph we find the frequency for different project duration.

$$\Pr(duration < expected_{duration}) = \frac{\sum duration < expected_{duration}}{1000}$$





The probabilities are 0.847, 0.944 respectively. So the project could be finished within 566 days with probability 0.854*0.949=0.81.

Reference:

[1] Zavadskas, Edmundas Kazimieras, Zenonas Turskis, and Jolanta Tamošaitienė. "Https://Journals.Vgtu.Lt/Index.Php/JCEM/Article/View/5898." *JOURNAL OF CIVIL ENGINEERING AND MANAGEMENT* 16, no. 1 (March 31, 2010): 33–46. https://doi.org/10.3846/jcem.2010.03.

[2] Software, Raptor Project Management. "Construction Risk Assessment." *Construction Project Management* (blog), August 21, 2017. https://medium.com/construction-project-management/construction-risk-assessment-1b7d8e395520.