36109 Assignment 1 A: Monte Carlo simulation of a project

The challenge

You have been assigned responsibility for a system implementation project involving an external vendor and an internal team and, as a first task, have been asked to provide a time estimate for project completion. The two teams have jointly provided you with the following estimates:

The first part of the project – the planning phase – involves both teams and will take between 2 and 5 days, with a most likely completion time of 3 days.

The second phase involves the two teams *working independently* to develop modules that will be integrated later in the third phase. For the second phase, the two teams have provided the following three-point estimates for their modules:

Vendor:

Minimum: 8 days

Maximum: 16 days

Most Likely: 10 days

Internal team

Minimum: 7 days

Maximum: 13 days

Most Likely: 9 days

The third phase – integration and testing – is jointly estimated by the two teams. They reckon it will take at least 8 and at most 14 days to complete, with a most likely completion time of 9 days. Finally, there is a training and rollout phase which is done by the internal team. This can take either 2 or 3 days, with a 75% chance of the former and 25% chance of the latter.

1. Produce a sequence diagram for the project, showing min, most likely and maximum times for each task. You can use any diagramming tool you are familiar with. If you're looking for a free tool, try http://draw.io. Please ensure your output is a readable graphics file – jpg, png, pdf or bmp.
2. Set up a Monte Carlo simulation in R with the following (you can use the examples provided in class as templates or create your own):
    a. Simulations of 1000 runs of the project, with the tasks connected appropriately.
    b. A probability distribution curve for the entire project.
    c. A cumulative probability distribution curve (CDF) for the entire project.
3. Which curve would you use to estimate completion times? Why?
4. How likely is it that you will complete the project within 27 days?
5. What is the 90% likely completion time? That is, what is the time associated with a 90% chance of completion?
6. Write a short note describing:
    a. The rationale behind the method.
    b. The assumptions made. Are they reasonable?

7. An old project management adage is, *late projects tend to become later*. How would you implement this using Monte Carlo simulation? Illustrate using an example.

The deliverables
1. Monte Carlo simulation code in R.
2. Short report (pdf) answering the questions posed above (750 to 1000 words max).