**Engineering Economics Fall 1398**
**Fourth Assignment – Simulation Analysis (Optional)**

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Consider a project the following information.

- First Cost:
  - Constant. 100 Million Toman (MT)
- Annual Operating costs:
  - Variable. It follows a normal distribution with mean of 25MT and standard deviation of 5 MT.
- Annual Operating revenues:
  - Variable. It follows a uniform distribution with the range of 50MT – 80MT.
- Salvage value:
  - Variable. It depends on the life of the project as shown in the bellow table.
- Project life:
  - Variable. It follows a discrete distribution as shown in the bellow table.

| Life, year | Salvage value, MT | Probability |
|---|---|---|
| 4 | 50% of first cost | 10% |
| 5 | 40% of first cost | 20% |
| 6 | 30% of first cost | 30% |
| 7 | 20% of first cost | 30% |
| 8 | 10% of first cost | 10% |

- Effective tax rate:
  - Constant. 30% annually
- Minimum Attractive rate of return:
  - Constant. 12% per year
- Average inflation rate per year
  - Variable. It follows a uniform distribution with the range of 10% - 15%.
- Depreciation method:
  - Straight line (SL)

In order to do this assignment, the following items have to be performed.

a) Apply Getformula function to display the utilized formula in your Excel file.

b) For each simulation run, first calculate inflated Cash Flow After Tax (CFAT*) and then calculate its PW using market rate or inflation-adjusted MARR using/without VBA functions in Excel.

c) After performing the simulation, calculate sample mean ($\mu$) and sample standard deviation ($\delta$) of PWs then calculate probability of having positive PW, P(PW>0) and the three following ranges: $\mu \pm 1*\delta$, $\mu \pm 2*\delta$, and $\mu \pm 3*\delta$.

d) Repeat the above-mentioned simulation three times using 1000, 2000, and 5000 simulation runs in three different worksheets of your Excel file.

e) Provide summary of results for the three simulations in a new worksheet of your Excel file. Please provide the following information: $\mu$, $\delta$, P(PW>0), $\mu \pm 1*\delta$, $\mu \pm 2*\delta$, and $\mu \pm 3*\delta$.

**IMPORTANT: If you don't have time to do this assignment, you are not required to do that. Hence do not copy from your colleagues!**

Please use Microsoft Excel for doing this assignment, and everybody must submit **his/her own solution** as a single Excel file with multiple worksheets **no later than Dey 26 , 1398 only through LMS**.
Sending the assignment to my email is not acceptable.

Good luck!
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Dey 14, 1398