FIN325 - Homework 3
Due : Tuesday October 12 by midnight, on canvas, pdf only

Problem 1 (30pts)

Two investors are going to co-invest in a three-year project whose cost in year 0 is \$100M. Investor 1 is a passive investor that finances 90% of the cost of the project. Investor 2 (the operator) finances 10% of the initial cost and will run the project. In the benchmark scenario, the project will generate \$50M in year 1, \$50M in year 2, and \$30M in year 3.

The contract between the two investors features an incentive clause for the operator. Specifically, cash-flows will be distributed according to the initial stake (90% to the passive investor, 10% to the operator) until the passive investor gets an IRR of 10%. Once enough cash flows have been generated to deliver this return, excess cash flows will be split 50-50 (50% to the passive investor, 50% to the operator.)

If the benchmark scenario materializes, what IRR is the operator going to get from this project?

Problem 2 (35pts)

A lender has agreed to issue a fully amortizing bond with face value \$100M, twenty yearly payments, and an interest rate of 10%. Payments will grow by g% a year for 10 years. After year 10, payments are flat. (So year 11 payment is the same as year 10, as are all subsequent payments)

1. If $g = 1\%$, what is the bond's outstanding principal at the start of year 5?
2. Above what growth rate does the bond begin to feature negative amortization, holding the interest rate the same?

Problem 3 (Monte Carlo, 35 pts)

(*When you turn in your answers for this question, only show a few numbers from your tables, not pages and pages of output.*)

Consider an investment project which yields cash flows for up to 20 years. Starting the project costs $\$500,000$. The project's subsequent cash flows follow what is called

a *Markov Process* where the probability distribution of next year's cash flow depends on this year's cash flow. Markov processes try and capture in a parsimonious fashion the possibility that good times or bad times may be persistent. In the first year, the project's cash flow is $\$50,000$ with certainty. Each year, there is a 2% probability that next year's cash flow will be zero. Once it is becomes zero, it stays there for ever. In this context, zero is called an *absorbing state.*

If this year's cash flow is not zero yet, then there is a 10% probability that next year's cash flow will be higher by 10%, and a 10% probability that it will be lower by 10%. With the remaining probability, namely 78% ($= 100 - 2 - 10 - 10$), the cash flow is unchanged.

1. Use Excel's random number generator to simulate 500 possible cash flow paths for the project.

2. Use these 500 simulated paths to estimate the expected value of the cash flow in each of the project's year. That is, for each year, average cash flow values across the 500 paths.

3. Assuming a discount rate of 10%, calculate the net present value of the project using your estimates of expectations. (Warning: Excel's NPV formula discounts the first cash flow so do the NPV for all cash-flows starting in year 1 and then subtract the cost of the project.)

4. Now calculate the present value of each random path separately using the same discount rate, and calculate the average of the 500 resulting values. Is the final result the same as in the previous question?

5. Estimate the project's IRR using your simulated estimate of the expected value of the cash flow in each period.

6. Now calculate the IRR associated with each of the paths you generated.[1] Then calculate an report the average of the resulting 500 IRRs. Do you get the same value as in the previous question?

[1]Warning: sometimes Excel's IRR function gets stuck, basically because it is not "trained" to look for very negative IRRs. Long story short, if that happens, write, say, IRR(A1:A20,-0.8), rather than simply IRR(A1:A20), which will start the search at -80%.