Problem 1. Airtel's Acquisition Decision (Option to Expand)

Airtel is planning to acquire a Kuwaiti firm, Zain that allows it to expand into 15 African nations. This acquisition would give Airtel an option to start operations in these nations 3 years from now at a cost of \$6 Billion. The present value of cash flows from this potential option is \$4 Billions. The annual volatility, σ in estimated demand for mobile services in Africa is 50%. The risk-free rate is 10%.

(a) What is the NPV of this acquisition.

(b) Based on NPV alone, would you choose to acquire Zain?

(c) What is the option value of this expansion option. (**Hint:** Use the Black-Scholes formula to value this acquisition opportunity.)

(d) How Much should Airtel be willing to pay to acquire Zain.

Problem 2. Pfizer's Option to Delay

Pfizer has developed a new drug for Alzheimer's disease. Pfizer is evaluating two choices. It can either incur an investment cost of \$1 Billion to start production today or wait for 1 year and incur a cost of \$1.1 Billion. The present value of expected cashflows is \$2 Billions. The annual volatility, σ in estimated demand for this drug is 50%. The risk-free rate is 10%.

(a) What is the NPV from starting production today?

(b) What is the NPV of production with the option to wait 1 year?

(c) Should Pfizer wait for 1 year or start production today.

(d) **Alternate scenario:** Now assume that Pfizer can wait 3 years to start production, again at estimated cost of \$1.1 Billion. What is the NPV of production with the option to wait 3 years?

(e) What is the value of this added flexibility to wait for 3 years under this alternate scenario?

(f) Should Pfizer wait under the alternate scenario?

Problem 3. Ford's Option to Abandon

Ford is planning to launch Ford Ecosport in India. It has to choose between two alternative production technologies. The first option is an efficient technology that can produce higher volumes at lower cost. The cost of this technology is \$300 Millions. But there is no resale market for this technology. The second technology requires more labor and produced lower volumes. It also costs \$300 Millions. However, it has a resale value of \$150 Millions. The present value of expected payoffs from the two technologies under the potential scenarios are given in the following table.

Probability	Scenario	PV(Tech 1 Payoff)	PV(Tech 2 Payoff)
1/2	High Demand	550	600
1/2	Low Demand	150	50

(a) Map the choices onto a decision tree.

(b) Evaluate the NPV from using Technology 1.

(c) Evaluate the NPV from Technology 2.

(d) Evaluate the NPV from Technology 2 without the option to resell.

(e) What is the value of the added flexibility to abandon (resale)?

Problem 4. Value of Options Under Uncertainty

(a) Evaluate the value of Airtel's Expansion option if the annual volatility, σ in estimated demand for mobile services in Africa is 10%.

(b) Evaluate the value of Pfizer's option to delay investments by 3 years if the annual volatility, σ in estimated demand for mobile services in Africa is 10%.

(c) What is the reduction in Pfizer's option to delay due to the reduction in uncertainty.

(d) What does the tell you about the impact of reduction in uncertainty on the real options to expand or delay investments? Explain.

Problem 5. Value of Options and Risk-free rate

(a) Evaluate the value of Airtel's Expansion option if the risk-free rate is 5%.

(b) What is the impact of a reduction in risk-free rate on Airtel's expansion option?