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

(a) NPV=$4 - \frac{\$6}{1.1^3} = \$ - 0.507$

(b) I will not choose to acquire ZAIN based on NPV alone as NPV is negative.

(c) Using the Black-Scholes formula the present value of this expansion option turns out to be $1.2 Billions.

(d) Airtel would be willing to pay anything less than $1.2 Billions to acquire Zain.

Solution 2.   Pfizer's Option to Delay

(a) NPV of starting production today=$2-$1=$1 Billion.

(b) NPV with the option to wait 1 year ≈$1 Billion based on Black-Scholes Formula.

(c) Since, the NPV with option=NPV without option, Pfizer's payoff from investing today is the same as the payoff from making the investment 1 year from now, Pfizer will be indifferent between the two alternatives. So, it can invest today.

(d) NPV with the option to wait 3 year ≈$1.3 Billion based on Black-Scholes Formula.

(e) The value of added flexibility=NPV with option-NPV without option=$1.3-$1=$0.3 Billions.

(f) Yes, Pfizer should wait under the alternate scenario as The NPV with option to wait 3 years ($1.3 Billion) exceeds the Current NPV of $1 Billion. So waiting is valuable.

Solution 3.   Ford's Option to Abandon

(a) See Figure 1

(b) NPV=PV(expected cash flows) - PV(cost)=1/2*(550)+1/2*(150)-300=$50 Millions.

(c) NPV with option to resell=1/2*(600)+1/2*(150)-300=$75

(d) NPV without option to resell=1/2*(600)+1/2*(50)-300=$25

(e) Value of flexibility=NPV with option-NPV without option=$75-$25=$50.

Solution 4.   Value of Options Under Uncertainty

(a) The value of Airtel's Expansion option when $\sigma = 0.1$ is $0.12 Billions.

(b) The value of Pfizer's option to delay by 3 years when $\sigma = 0.1$ is $1.18 Billions.

(c) The reduction in the value Pfizer's of option to delay is $1.3 - \$1.18 = \$0.12$Billions.

(d) A reduction in uncertainty reduces the value of the option to delay. This is because the chances of an upside gain is limited when their is lower uncertainty.
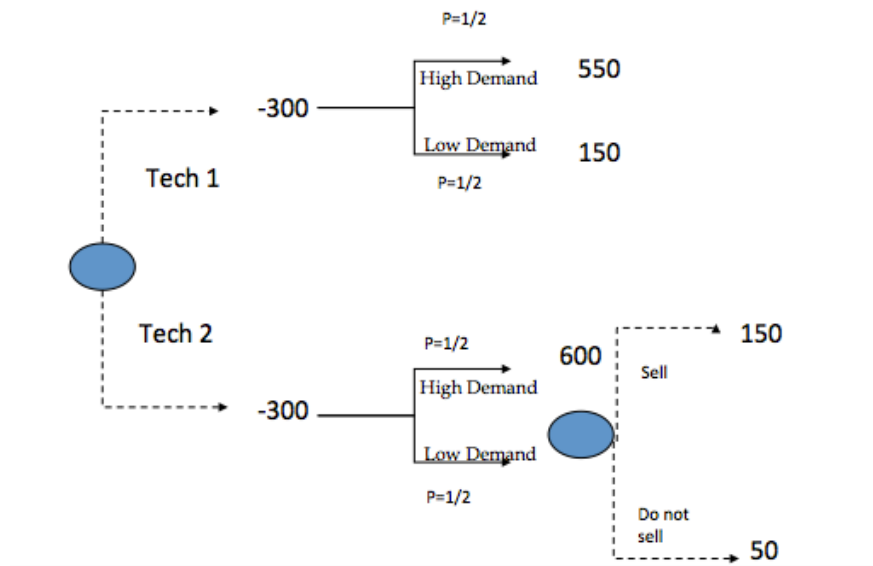
Figure 1: Problem 3 (a)

Solution 5.   Value of Options and Risk-free rate

(a) The value of Airtel's Expansion option when risk-free rate=5% is $\approx$\$1 Billions.

(b) A reduction in risk-free rate reduces the value of the option to expand.