

## Session 21: Post Class tests

1. You have been asked to value a portfolio of patents that is owned by a technology company and are considering using option pricing in the endeavor. In which of the following cases is using a real options approach likely to yield a much higher value than using a discounted cash flow approach?
  - a. A viable patent with 3 years to expiration in a safe business
  - b. A viable patent with 12 years to expiration in a safe business
  - c. A non-viable patent with 1 year to expiration in a risky business
  - d. A non-viable patent with 12 years to expiration in a risky business
  - e. All of the above
  - f. None of the above
2. Assume now that you have decided to employ an option pricing approach to value a patent on a drug to treat Alzheimer's. You believe that, if the drug were introduced today, it would generate expected cash flows of \$ 150 million/year for the next 15 years, and that the cost of commercially developing the drug today is \$2 billion. If the risk free rate is 3% and the cost of capital for pharmaceutical companies is 10%, what would you use as the value of the underlying asset (S) in the option pricing model?
  - a. -\$859 million
  - b. \$250 million
  - c. \$ 1,141 million
  - d. \$1,791 million
  - e. \$2,250 million
  - f. None of the above
3. Let us assume that you value the patent to be worth \$133 million, using an option pricing model, and that you used the remaining life of the patent (which is 15 years) as the option life in your valuation. How would your assessment of the value change if you were told that a competitor is working on a close substitute to treat Alzheimer's and is planning to bring the drug to the market in 5 years?
  - a. Lower the value of the patent
  - b. Have no effect on the value of the patent
  - c. Increase the value of the patentExplain.
4. A key input into option pricing models is the expected volatility in the underlying asset's value. In valuing a Alzheimer's drug patent as an option, which of the following approaches can you use to estimate the volatility in the "underlying" asset?
  - a. A simulation of the present value of the cash flows from developing the drug today, with different assumptions about the market size and profitability
  - b. The standard deviation in the firm values of small publicly traded, pharmaceutical companies.
  - c. The implied standard deviation in the options traded on stocks of publicly traded pharmaceutical companies, funded primarily with equity.
  - d. The standard deviation in the cash flows of drugs introduced in the past

- e. Any of the above
5. You are a gold mining company with substantial undeveloped reserves of gold and relatively little gold production. Which of the following combinations will make your gold reserves more valuable?
- a. High gold prices with low volatility in those prices
  - b. High gold prices with high volatility in those prices
  - c. Low gold prices with low volatility in those prices
  - d. Low gold prices with high volatility in those prices

## Session 21: Post class test solutions

1. **d. A non-viable patent with 12 years to expiration in a risky business.** The option premium over the DCF value is greatest when an option is on a risky underlying asset, has a long time to expiration and is out of the money.
2. **c. \$1,141 million.** It is the present value of \$150 million for 15 years, using the cost of capital of 10% as your discount rate.
3. **a. Lower the value:** It will be negative for two reasons. The first is that your cash flows will be lower, if you have competition and the second is that your option life will be reduced to 5 years.
4. **e. All of the above.** Any of the approaches can be used, though each comes with its own baggage. The standard deviations from publicly traded companies may not be reflective of the risk in the projects that these companies take. The simulation is only as good as the distributions used to derive the results.
5. **c. High gold prices with high volatility.** When gold prices are high, the exercise value of the reserves will be high. When volatility is high, there will be a higher option premium on these reserves.