Short-Answer

1. Is the option to abandon a failing project most similar to a short call, a long call, a short put, or a long put?

2. Borrowers can prepay mortgages without penalty. Why does this right lead to higher interest rates on mortgages than would be the case if mortgages could not be repaid early?

3. Assume that your firm is considering investing $1,000,000 in a new factory that is expected to produce cash flows with a present value today of $1,150,000. The standard deviation of returns on the factory is 25%. Alternatively your firm could wait a year before investing. In your firm waits, the present value of expected cash flows would fall to $950,000. The risk-free rate of return is 3.5%. Assume you want to decide whether your firm should invest now or should wait a year by using the Black-Scholes option pricing model to value the option to delay. List the 5 variables you would need to use to calculate d_1 and give the value of each variable.

4. Assume that your firm is considering investing $800,000 in a new plant. If a Demolican is elected (there is a 55% chance of this), sales will equal the factory's capacity and net cash flows will equal $75,000 per year forever. If a Repubocrat is elected (there is a 45% chance of this), demand will exceed the capacity of the factory. However, additional capacity can be added at a cost of $500,000 a year from today (after the election) and will allow net cash flows to equal a total of $120,000 per year forever. (If additional capacity is not built, then net cash flows will continue to equal $75,000 per year). Sketch a decision tree that could be used to determine whether or not your firm should build the new plant today. Note: no need to set up any calculations, simply sketch the tree and add any information relevant to your analysis.

5. Is the option to delay most similar to a short call, a long call, a short put, or a long put?

6. Assume you are valuing an option to delay. In the Black-Scholes model, how would you incorporate any cash flows that would be lost if the investment is delayed?

7. Assume that your firm is considering investing $1,000,000 in a new factory that is expected to produce cash flows with a present value today of $1,150,000. If demand exceeds expectations, the plant can be expanded any time over the next 3 years at a cost of $800,000. The present value today of the expected cash flows from the expansion is $450,000. The standard deviation of returns on the factory is 25% and on the expansion is 35%. The risk-free rate of return is 3.5%. Assume you want to decide to value the option to expand by using the Black-Scholes option pricing model. List the 5 variables you would need to use to calculate d_1 and give the value of each variable.

8. Assume that your firm is considering investing $800,000 in a new plant. If a Repubocrat is elected (there is a 55% chance of this), the factory will produce net cash flows of $85,000 per year forever, and if a Demolican is elected (there is a 45% chance of this), the factory will produce $25,000 per year forever. Rather than continuing production if a Demolican wins, the plant could be sold for $500,000. Sketch a decision tree that could be used to determine whether your firm should build the new plant. Note: no need to set up any calculations, simply sketch the tree and add any information relevant to your analysis.

9. Is the option to expand most similar to a short call, a long call, a short put, or a long put?

10. Why is the ability to wait before making an investment decision valuable?

11. Assume that your firm is considering investing $1,000,000 in a new factory that is expected to produce cash flows with a present value today of $1,150,000. The standard deviation of returns on the factory is 25%. If demand falls short of expectations, the plant can be sold any time over the next 3 years for $500,000. The risk-free rate of return is 3.5%. Assume you want to value the option to abandon the new factory by using the Black-Scholes option pricing model. List the 5 variables you would need to use to calculate d_1 and give the value of each variable.

12. Assume that your firm is considering building a factory that would have a net present value today of $50,000. Alternatively, your firm could wait until a year from today to see who wins the next election. At that time you estimate that it will cost $800,000 to build the factory. If a Repubocrat is elected (there is a 55% chance of this), the factory will produce net cash flows of $85,000 per year forever. If a Demolican is elected (there is a 45% chance of this), the factory will produce $25,000 per year forever. Sketch a decision tree that could be used to determine whether your firm should invest now (pior to the election) or should wait a year until after the election (at which time sales will be know for certain) to make a decision. Note: no need to set up any calculations, simply sketch the tree and add any information relevant to your analysis.

13. Suny Electronics is considering whether to build a factory that manufactures voice-controlled computers. Suny Electronics must decide whether to build the factory now or wait until a year from today to build it. If Suny builds the factory now, there is a 25% chance that initial sales will equal $10 million per year and a 75% chance that initial sales will equal $50 million per year. There is a 45% chance that sales will grow by 3% per year and a 55% chance that sales will grow by 7% per year. The initial sales and growth of sales are independent. If Suny waits until a year from today to invest, it will know the size of the voice-controlled computer market and thus initial sales. However, it will not know the rate at which sales will grow until after it builds the factory. Sketch a decision tree that can be used to determine whether Suny should build the factory now or wait until next year. Note: no calculations necessary.

14. If you wanted to use the Black-Scholes Option Pricing Model to determine the value today of being able to expand a project later, what would you use for K?

Problems

1. Suppose a firm is considering a project costing $530,000 that is expected to provide cash flows over the next 5 years with a present value of $525,000. The standard deviation of returns on the project is 41%. If the project fails to live up to expectations, the facility can be sold for $300,000 any time within the next 2 years. The return on Treasuries varies by year as follows: 1-year = 2%, 2-year = 2.5%, 3-year = 3.1%, 4-year = 3.4%, and 5-year = 3.6%.

   a. Would the project be worthwhile if it were not possible to sell the facility?
   b. Is the project worthwhile given the ability to walk away?

2. Suppose a firm is considering building a new factory at a cost of $250,000. This factory is expected to produce cash flows with a present value of $245,377.02. Within 2 years, if the product is a success, then the plant could be expanded at a cost of $125,000. The present value today of the expected cash flows from this expansion equals $98,629.63. The standard deviation of returns on the expansion is 27%. The return on a 2-year Treasury strip is 3.5% per year.

   a. Would the factory be worth building if it were not possible to expand later?
   b. Is the project worthwhile given the possibility of expanding later?

3. TexEx is considering building a new distribution center in Waco at a cost of $2 million. The distribution center will allow TexEx to deliver packages to Dallas/Ft. Worth, Austin, Abilene, and Tyler. TexEx estimates that that building the distribution center will generate incremental net cash flows over the next 15 years with a present value today of $2.2 million. If sales are less than expected, TexEx estimates that it can sell the distribution center for $1.1 million three years from today. The present value of cash flows prior to this potential sale equal $300,000 of the $2.2 million total. TexEx estimates that the cost of capital for the distribution center is 14%. The volatility of returns on the distribution center equals 44% over the next 3 years and 39% over its 15-year life. The risk-free rate varies by maturity as follows: 1-year = 1%, 2-year = 2%, 3-year = 2.9%, 4-year = 3.1%, 5-year = 3.3%, 10-year = 5.6%, and 15 year = 6.1%.
   a. Calculate the value of building this distribution center were it not possible to sell the center three years from today if sales end up being less than expected.
   b. Calculate the value of building the distribution center given that the center can be sold three years from today if sales end up being less than expected.

Multiple-Choice

1. For which of the following types of capital budgeting projects can decision trees NOT be used?

a. projects that can be shut down rather than continuing to operate if they fail to live up to expectations
b. projects that involve a small investment today that can lead to an expansion if successful
c. opportunities to undertake investments in the future
d. projects that can be undertaken now or which can be delayed until some future date
e. all of the above can be solved with decision trees

Chapter 22 Problems

Use the following information to answer questions 2 through 5.

Puntiac Motors is considering building a factory to assemble hybrid cars. If sales exceed expectations, additional capacity can be added and if sales fall short of expectations, the factory can be sold. Information on various aspects of the project follow:

Information on Puntiac's existing assets: expected life = 15 years; cost to replace = $50,000,000; present value of the cash flows from the assets = $40,000,000; standard deviation of returns = 44%
Information on the factory: expected life = 20 years; cost to build = $6,000,000; present value of cash flows from the factory = $7,000,000; standard deviation of returns = 55%; price at which the factory can be sold if sales fall short of expectations = $4,500,000; time over which the factory can be sold for $4,500,000 if sales fall short of expectations = 4 years
Information on the additional capacity: expected life = 10 years; cost to add the additional capacity = $3,000,000; present value of the cash flows from the additional capacity = $2,200,000; time over which the additional capacity can be added = 5 years; standard deviation of returns = 66%
Information on the firm as a whole if the new factory is built: expected average life of the firm's assets = 16 years; present value of the cash flows from the firm's assets = $47,000,000; standard deviation of returns on the firm's assets = 46%
Information on the firm as a whole if the additional capacity is added: expected average life of the firm's assets = 14 years; present value of the cash flows from the firm's assets = $49,200,000; standard deviation of returns on the firm's assets = 47%
Returns on Treasury strips by maturity: 1-month = 0.1%; 4-year = 1.8%; 5-year = 1.9%; 10-year = 3.0%; 14-year = 3.3%; 15-year = 3.4%; 16-year = 3.5%; 20-year = 3.7%

2. Assume that you want to value the possibility of selling the factory if sales fall short of expectations using the Black-Scholes Option Pricing Model. What would you use for K when calculating PV(K)?
   a. 6,000,000
   b. 7,000,000
   c. 2,200,000
   d. 4,500,000
   e. 3,000,000

3. Assume you want to value the possibility of adding capacity using the Black-Scholes Option Pricing Model. What rate would you use in calculating PV(K)?
   a. 3.4%
   b. 3.5%
   c. 0.1%
   d. 1.9%
   e. 3.0%

4. Assume that you want to value the possibility of selling the factory if sales fall short of expectations using the Black-Scholes Option Pricing Model. What would you use for σ?
   a. 0.46
   b. 0.47
   c. 0.55
   d. 0.66
   e. 0.44

5. Assume you want to value the possibility of adding capacity using the Black-Scholes Option Pricing Model. What would you use for S?
   a. 49,200,000
   b. 2,200,000
   c. 40,000,000
   d. 3,000,000
   e. 47,000,000

6. The ability to delay an investment rather than undertaking it now is most similar to which of the following options or combination of options?

a. a short put
b. a long put
c. a short call
d. a long call
e. a combination of two of the above