

**NYU Stern School of Business**  
**Corporate Finance**  
**B40.2302.11, .12**  
**Fall 2001**

**Midterm Solutions**

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Note to Wednesday section: Please do not discuss this exam with members of the Thursday section. (Doing so would only move the curve against you!)

The questions are equal-weighted unless otherwise indicated. (In multi-part questions, each “-“ is the equivalent of one full question.)

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1) What is the main disadvantage to organizing as a corporation (in the United States)? (one sentence)

*Double taxation of dividend income.*

2) Write down (but do not “solve” for the actual numerical answer) the expression for the following:

- The present value of a cash flow stream that gives \$110,000 one year from now and \$40,000 five years from now, given an annually-compounded discount rate of 10% (one equation)

$$PV = 110,000/1.10 + 40,000/(1.10)^5$$

- The present value of a cash flow stream that gives \$50,000 six months from now, given an annually-compounded discount rate of 10% (one equation)

$$PV = 50,000/(1.10)^{0.5}$$

3) Explain intuitively why “maximization of shareholder wealth” is an uncontroversial corporate goal, even for shareholders that have different preferred “time patterns” for consumption. Hint: think ants and grasshoppers. (No more than four sentences.)

*Investors can achieve their preferred pattern of consumption over time by borrowing against their current wealth (e.g. the grasshopper in our example) or lending their current wealth (e.g. the ant in our example). Therefore, whatever their preferences for consumption across time, they will all agree on that the corporation should maximize current wealth.*

4) All else equal, the value of a stock (select all that are true):  
(a) Increases as the dividend growth rate “g” increases  
(b) Increases as the required rate of return “r” decreases  
(c) Increases as the required rate of return “r” increases  
*(a) and (b) are true. You can see this from the growing perpetuity formula:  $P = D_1/(r-g)$ .*

5) The payback rule for capital budgeting (select all that are true):  
(a) Requires an arbitrary cutoff date  
(b) Doesn't account for the time value of money for cash flows that occur before the cutoff date  
(c) Doesn't count cash flows that occur after the cutoff date  
*(a), (b), and (c) are true.*

6) If you have to do capital budgeting under multiple constraints (say, limits on capital investment in each of several years), what technique should you use? (One sentence.)  
*You should set up and solve a “linear program.”*

7) Mrs. T. Potts, treasurer of Ideal China, has a problem. The company has just ordered a new kiln for \$400,000. Of this sum, \$50,000 is described by the supplier as an “installation cost.” Mrs. Potts does not know whether the IRS will permit the company to treat this cost as (1) a tax-deductible current expense or (2) a capital investment. (In either case, the next tax accounting cycle is one year from now, so that is the first opportunity to reduce the tax bill.) The tax rate is 35% and the opportunity cost of capital is 5%.

- What is the PV of the tax shield in case (1)? (Write down the expression, don't need to solve)

*If the \$50,000 is expensed at the end of year 1, the value of the tax shield is  $.35*50,000/1.05 = \$16,667$ .*

- What is the PV of the tax shield in case (2)? Assume that in this case the company depreciates the \$50,000 using the 3-year tax depreciation schedule indicated in BM6 Table 6.4, page 130. (Write down the expression, don't need to solve)

*If instead it is capitalized and then depreciated according to the MACRS schedule, the value of the tax shield is  $.35*50,000*(.333/1.05 + .4445/1.05^2 + .1481/1.05^3 + .0741/1.05^4)$ .*

- Which does the treasurer prefer if given the choice, (1) or (2)? Hint: You should not have to do any math to solve this. (One sentence.)

*Given the choice, the treasurer would always prefer to expense as in (1), because it is essentially accelerating depreciation (and thus the tax shield) 100% to the first year, which is most valuable due to time value of money.*

8) In a given year, a firm has new capital investment of \$100,000, sales of \$80,000, depreciation expense of \$20,000, cost of goods sold of \$5,000, and an increase in net working capital (required for ongoing operations) of \$25,000. The tax rate is 35%. What is the firm's after-tax net cash flow for this year? (Write down the expression, do not solve.)

$$= -100,000 - 25,000 + (80,000 - 5,000) - .35*(80,000 - 20,000 - 5,000)$$

*(new cap investment - chg. nwc + operations cash flows - taxes)*

9) Suppose you are forced to choose between two manufacturing technologies, A and B. Both machines have identical capacity and do the same job.

Machine A costs \$20,000, lasts 10 years (no salvage value), costs \$5,000 per year to run (first annual cost payment occurs at the end of the first year).

Machine B costs \$10,000, lasts 5 years (no salvage value), costs \$5,000 per year to run. (first annual cost payment occurs at the end of the first year)

The discount rate is 7%. Which machine to recommend? Let's solve this step-by-step:

- Write down (don't solve) the expression for PVC(A), the present value of the cost of running machine A for its life. (Use the annuity formula to make it shorter.)

$$PVC(A) = 20,000 + 5,000*(1/.07 - (1/.07)/(1.07)^{10})$$

- Write down (don't solve) the expression for PVC(B), the present value of the cost of running machine B for its life. (Use the annuity formula to make it shorter.)

$$PVC(B) = 10,000 + 5,000*(1/.07 - (1/.07)/(1.07)^5)$$

- The 10-year annuity factor at 7% is 7.024. Write down (don't solve) the expression for EAC(A), the equivalent annual cost of A, in terms of this annuity factor and PVC(A).

$$EAC(A) = PVC(A)/7.024$$

- The 5-year annuity factor at 7% is 4.100. Write down (don't solve) the expression for EAC(B), the equivalent annual cost of B, in terms of this annuity factor and PVC(B).

$$EAC(B) = PVC(B)/4.100$$

- Given EAC(A) and EAC(B), how to choose between A and B?  
*Take the one with lower EAC.*

10) What is the beta:

- Of a riskless asset? (one number)  
*Zero.*
- Of the market portfolio? (one number)  
*One.*
- Of the “average” risky asset? (one number)  
*One.*

11) Assuming the Capital Asset Pricing Model is correct, explain how you would estimate Merck’s cost of equity. (Indicate the three inputs you would need, and how to combine them to get a cost of equity.)

*Riskfree rate ( $R_f$ ), Beta of Merck’s equity ( $Beta_{Merck}$ ), Market risk premium ( $E[R_m] - R_f$ ):*  
 $R_{Merck} = R_f + Beta_{Merck} * (E[R_m] - R_f)$

12) Today the Nobel Prize in Chemistry is announced. So let’s practice “financial alchemy” of options (groan). Explain the set of trades that you would do to construct payoff diagrams A and B (on the board). Don’t forget to specify the strike/exercise prices of any options you might use.

*A: Buy a call with strike price 25, sell a call with strike price of 50. (There may be more complicated, equivalent ways to do this.)*

*B: Sell a put with strike price of 60, sell a call with strike price of 60. (There may be more complicated, equivalent ways to do this.)*

13) List the 5 variables you need to evaluate the Black-Scholes formula for a European call option. (Don’t just list 5 symbols -- explain in a few words what each symbol represents.)

*r riskfree rate*

*S strike price*

*t time to maturity/expiration*

*P current stock price*

$\sigma$  *standard deviation of continuously compounded stock return*

14) You have to choose between a generic production technology (A) or a specialized, fully automated technology (B). B has lower per-unit costs than A but, because it is specialized, it also has zero salvage value. You don't know whether demand for your product is going to be high or low. You need to decide whether to implement A or B.

A leads to cash flows of 30 if high demand, 10 if low demand

B leads to cash flows of 31 if high demand, 11 if low demand

One year into project, demand is revealed. At that point you can abandon A (if you want) for a salvage value of 13.

- What variety of “real option” is this?

*An option to abandon – A comes with a put option*

Let's value the put option that comes with A. Suppose that if A **can't** be abandoned, it would be worth 15. And if that were the case, its value would rise 100% if high demand (from 15 to 30) and fall 33.3% if low demand (from 15 to 10). Suppose abandonment is possible 1 year from now, and the riskless rate is 5%. Let's solve for the value of the put using the risk-neutral method.

- Write down the expression that (if you had a calculator) you could solve for “RNProb(high demand)”

$$5 = RNProb(high\ demand)*100 + (1-RNProb(high\ demand))*(-33.3\%)$$

- Write down the expression for the value of the put option ( $V_{put}$ ) in terms of the variable “RNProb(high demand)”

$$V_{put} = (1/1.05)*[RNProb(high\ demand)*0 + (1-RNProb(high\ demand))*3]$$

*(The 3 is 13 – 10)*

- Explain how to calculate the total value of technology A, given  $V_{put}$

$$Total\ value\ of\ A = 15 + V_{put}$$