Due in class, October 3rd (.11 section) or 4th (.12 section).

Hard copy is strongly preferred, but if you can’t attend class, you can email solution by 6pm October 4th to Keith Siilats [ksiilats@stern.nyu.edu].

Can work in teams of up to three students. Be sure to list all team members’ names.

The questions are equal-weighted unless otherwise indicated.

1) List three advantages to organizing as a corporation.

Possible answers include: corporations can live forever (so an investor can pass away or divest without upsetting operations); ownership is more easily transferred; can raise capital from a larger investor base; limited liability

2) What are the two reasons for discounting future cash flows?

Time value of money: Dollar today is worth more than a dollar tomorrow. Risk: Safe dollar is worth more than a risky one.

3) State the NPV rule for capital budgeting.

Accept projects with NPV>0.

4) The economy has three states: good, bad, and ugly (very bad). The first two states occur with probability .40 each, and ugly occurs with probability .20. You are considering an investment that pays off $100 in the good state, $50 in the bad state, and $10 in the ugly state. The discount rate appropriate for these cash flows is 15%. What is the most you would be willing to pay for this project?

You would be willing to pay the PV of the project, but no more.

\[
PV = \frac{(.4*100+.4*50+.2*10)}{(1.15)} = $53.91.
\]

5) You can borrow and lend at 10% per year. You have an income of $90,000 this year (count it as today’s dollars) and $120,000 next year (count it as one-year-away dollars).
What is the most you can possibly consume this year? What is the most you can possibly consume next year? What is the present value of these two consumption plans? (Assume: you retire after next year, and there is no bankruptcy option.)

To maximize today’s consumption, you spend your income this year, $90,000, and borrow against next year’s income, $120,000/1.10 = $109,091. Total you can consume now is $199,091.

To maximize next year’s consumption, invest (lend) $90,000 at 10% and then consume $90,000*1.10 + $120,000 = $219,000 next year.

Present value of first plan is $199,091. Present value of second plan is $219,000/1.1 = $199,091.

6) The NPV rule is valid for:
   (a) two period, certain cash flows
   (b) many period, certain cash flows
   (c) two period, uncertain cash flows
   (d) many period, uncertain cash flows
   (e) all of the above

(e). ((a),(b), (c) are special cases of (d).)

7) Which of the following statements are true?
   (a) The process of discounting is the inverse of the process of compounding.
   (b) Compound interest assumes that you are reinvesting the interest payments at the rate of return.
   (c) Holding $C_1$, $r$, and $g$ constant, the present value of a perpetuity is greater than the present value of an annuity (assume $r > g > 0$ and $C_1 > 0$).
   (d) Ending balances using simple interest are always greater than using compound interest (assume $r > 0$).

(a), (b), and (c) are true. [Keith: Some people apparently didn’t realize that I meant “growing perpetuity” and “growing annuity” in (c). It is not clear. Thus, count “(a) and (b)” as a right answer as well.]

8) 12% compounded monthly is equivalent to an annually-compounded rate of ___?
   A continuously-compounded rate of ___? When cash flows arrive in lumps at the end of each year, which rate is appropriate?

   Annually-compounded rate = $(1 + .12/12)^{12} = 12.68\%$.
   Continuously-compounded rate: $1.1268 = e^{r_1} \Leftrightarrow 11.94\%$.
   The annually-compounded rate is appropriate in the lumpy case.

9) State the assumption required to use the formula for the present value of a growing perpetuity. State when the first cash flow is assumed to arrive.
The key assumption is that \( r > g \). If \( r < g \), then even if dividends are growing perpetually, can’t use formula.

The first cash flow arrives at the end of the first period.

10) For a steadily growing firm, explain how to estimate the dividend growth rate given the payout ratio and the return on equity. If the payout ratio is constant, and the return on equity is constant, explain how to estimate the earnings growth rate.

\[
g (\text{dividends}) = \text{plowback ratio} \times \text{ROE} = (1 - \text{payout ratio}) \times \text{ROE}
\]

\[g (\text{earnings}) \text{ will be the same, since earnings, dividends, and book equity are all rising in proportion under these assumptions.}\]

11) You are considering an acquisition. The firm in question just paid its annual dividend of 0.40 per share. Under your management, you expect dividends to grow at 5% in perpetuity, with a discount rate of 10%. What is the most you would be willing to pay for a share in this firm?

The first dividend you could get is \(0.40 \times 1.05 = 0.42\). Using the growing perpetuity formula, the present value of this firm is \(0.42/(0.10-0.05) = 8.40\).

12) Explain two reasons for a high P/E ratio.

Low discount rate, or high present value of growth opportunities. (As stressed in class or in book page 73.)

13) If a project has an IRR equal to the opportunity cost of capital, what is the NPV of the project? If it has an IRR > opportunity cost of capital, what does the IRR rule recommend? Give an example in which this recommendation is incorrect.

Zero.

The IRR rule says undertake the project.

One example where this recommendation would be incorrect is if the initial cash flow is positive and the future cash flow is negative.

14) If you have to do capital budgeting with a limited amount of capital available for initial investments, what is the simplest technique to use?

You should maximize the weighted-average profitability index, i.e. spread your limited capital over the combination of projects that maximizes WAPI.

15) If the change in net working capital is positive, all else equal, should this be treated as a cash inflow or a cash outflow?
A cash outflow. More cash is being tied up in the business, e.g. in inventory, and therefore is not available to investors. At the end of the project working capital needs usually decline, so more is available to shareholders.

16) Solve BM 6th ed., Chapter 6, Practice Question #14. (Forecast cash flows for each year and calculate NPV. Assume the cash flows occur at the end of the year. Assume the company has other net income against which losses can be applied in the first year.)

\[
\begin{align*}
FCF(t0) &= -83.5 - 2.3 = -85.8 \\
FCF(t1) &= -2.1 + 27 - 9.2 - 15.5 + 3.8 = 4 \\
FCF(t2) &= -3.2 + 51.3 - 17.4 - 15.5 - 2.6 = 12.6 \\
FCF(t3) &= 0.7 + 89.1 - 30.3 - 5.2 - 16.7 = 37.6 \\
FCF(t4) &= 1.6 + 81 - 27.5 - 5.2 - 14.5 = 35.4 \\
FCF(t5) &= 2.1 + 62.1 - 21.1 - 5.2 - 9.5 = 28.4 \\
FCF(t6) &= 0.7 + 37.8 - 12.9 - 5.2 - 3.1 = 17.3 \\
FCF(t7) &= 2.5 + 29.7 - 10.1 - 5.2 - 1.0 = 15.9 \\
FCF(t8) &= 12.0 - 4.8 = 7.2 \\
NPV &= -85.8 + 4/1.11 + 12.6/(1.11)^2 + 37.6/(1.11)^3 + 35.4/(1.11)^4 + 28.4/(1.11)^5 + 17.3/(1.11)^6 + 15.9/(1.11)^7 + 7.2/(1.11)^8 = 15.73 \text{ million euros.}
\end{align*}
\]

17) The correlation between stock A’s return and the market return is 0.6. The standard deviation of the return on A is 30% and the market standard deviation is 20%. Calculate Stock A’s beta. Does Stock A have less or more market risk than the average security?

\[
\text{Beta} = \frac{\text{cov}(A,\text{market})}{\text{var}(\text{market})} = \frac{\text{corr}(A,\text{market}) \times \text{sd}(A) \times \text{sd}(\text{market})}{(\text{sd}(\text{market}))^2} = 0.60 \times 0.30 \times 0.20 / (0.20)^2 = 0.90.
\]
Since 0.90<1.00, stock A has less market risk than the average.

18) Efficient portfolios (select all that are true):
   (a) Offer the highest expected return for a given level of risk
   (b) Offer the lowest expected return for a given level of risk
   (c) Offer the lowest level of risk for a given expected return

(a) and (c) are true.

19) If the beta of Microsoft is 1.26, the risk-free rate is 5.5% and the market risk premium is 8%, calculate the expected return for Microsoft using the CAPM.

\[
= 5.5 + 1.26 \times 8 = 15.6\%
\]

20) Solve BM 6th ed., Chapter 9, Practice Question #9. (Use the CAPM in part (c))

\[
a) \text{With risk-free debt, Beta}_{\text{debt}} = 0, \text{ so Beta}_{\text{asset}} = E/V \times \text{Beta}_{\text{equity}}. \\
\text{Therefore Beta}_{\text{asset}, \text{United Food}} = .7 \times .8 = 0.56 \\
\text{Beta}_{\text{asset}, \text{General Electronics}} = .8 \times 1.6 = 1.28 \\
\text{Beta}_{\text{asset}, \text{Associated Chemicals}} = .6 \times 1.2 = 0.72
\]
These “pure play” firms’ betas are the best estimates we have available for Amalgamated Products’ food, electronics, and chemicals division betas.

\[ \text{b) Beta}_{\text{asset, Amalgamated Products}} = .5 \times 0.56 + .3 \times 1.28 + .2 \times 0.72 = 0.81 \]

Assuming risk-free debt for Amalgamated,

\[ \text{Beta}_{\text{asset, Amalgamated Products}} = \frac{E}{V} \times \text{Beta}_{\text{equity, Amalgamated Products}} \]

\[ 0.81 = 0.6 \times \text{Beta}_{\text{equity, Amalgamated Products}} \]

\[ \text{Beta}_{\text{equity, Amalgamated Products}} = 1.35 \]

c) Using the pure play betas,

\[ r_{\text{food}} = 0.07 + 0.56 \times (0.15 - 0.07) = 0.115 \]
\[ r_{\text{electric}} = 0.07 + 1.28 \times (0.15 - 0.07) = 0.172 \]
\[ r_{\text{chemicals}} = 0.07 + 0.72 \times (0.15 - 0.07) = 0.128 \]

d) Using Beta_{\text{debt}} = 0.2,

\[ \text{Beta}_{\text{asset, United Food}} = 0.7 \times 0.8 + 0.3 \times 0.2 = 0.62 \]
\[ \text{Beta}_{\text{asset, General Electronics}} = 0.8 \times 1.6 + 0.2 \times 0.2 = 1.32 \]
\[ \text{Beta}_{\text{asset, Associated Chemicals}} = 0.6 \times 1.2 + 0.4 \times 0.2 = 0.80 \]

Therefore

\[ r_{\text{food}} = 0.07 + 0.62 \times (0.15 - 0.07) = 0.120 \]
\[ r_{\text{electric}} = 0.07 + 1.32 \times (0.15 - 0.07) = 0.176 \]
\[ r_{\text{chemicals}} = 0.07 + 0.80 \times (0.15 - 0.07) = 0.134 \]