a. Which of the four plans has the lowest weighted average cost of capital? (Round to two places to the right of decimal point.)

b. Briefly discuss the results from Plan C and Plan D, and why one is better than the other.

20. Given the following information, calculate the weighted average cost of capital for Hamilton Corp. Line up the calculations in the order shown in Table 11–1. Weighted average cost of capital

Percent of capital structure:

Debt	30%
Preferred stock	15
Common equity	55

Additional information:

Bond coupon rate	13%
Bond yield to maturity	11%
Dividend, expected common	$3.00
Dividend, preferred	$10.00
Price, common	$50.00
Price, preferred	$98.00
Flotation cost, preferred	$5.50
Growth rate	8%
Corporate tax rate	30%

21. Given the following information, calculate the weighted average cost of capital for the Hadley Corporation. Line up the calculations in the order shown in Table 11–1. Weighted average cost of capital

Percent of capital structure:

Preferred stock	10%
Common equity	60
Debt	30

Additional information:

Corporate tax rate	34%
Dividend, preferred	$9.00
Dividend expected, common	$3.50
Price, preferred	$102.00
Growth rate	6%
Bond yield	10%
Flotation cost, preferred	$3.20
Price, common	$70.00

22. Brook's Window Shields, Inc., is trying to calculate its cost of capital for use in a capital budgeting decision. Mr. Glass, the vice-president of finance, has given you the following information and has asked you to compute the weighted average cost of capital. Changes in costs and weighted average cost of capital

The company currently has outstanding a bond with an 11.2 percent coupon rate and another bond with a 7.5 percent rate. The firm has been informed by its

Aftertax cost of debt

4. Calculate the aftertax cost of debt under each of the following conditions.

	Yield	Corporate Tax Rate
a.	6.0%	16%
b.	12.6	35
c.	9.4	24

Aftertax cost of debt

5. The Goodsmith Charitable Foundation, which is tax-exempt, issued debt last year at 8 percent to help finance a new playground facility in Los Angeles. This year the cost of debt is 20 percent higher; that is, firms that paid 10 percent for debt last year will be paying 12 percent this year.
   a. If the Goodsmith Charitable Foundation borrowed money this year, what would the aftertax cost of debt be, based on their cost last year and the 20 percent increase?
   b. If the receipts of the foundation were found to be taxable by the IRS (at a rate of 35 percent because of involvement in political activities), what would the aftertax cost of the debt be?

Aftertax cost of debt

6. Royal Jewelers Inc. has an aftertax cost of debt of 6 percent. With a tax rate of 40 percent, what can you assume the yield on the debt is?

Approximate yield to maturity and cost of debt

7. Airborne Airlines, Inc., has a $1,000 par value bond outstanding with 25 years to maturity. The bond carries an annual interest payment of $78 and is currently selling for $875. Airborne is in the 30 percent tax bracket. The firm wishes to know what the aftertax cost of a new bond issue is likely to be. The yield to maturity on the new issue will be the same as the yield to maturity on the old issue because the risk and maturity date will be similar.
   a. Compute the approximate yield to maturity (Formula 11–1 on page 329) on the old issue and use this as the yield for the new issue.
   b. Make the appropriate tax adjustment to determine the aftertax cost of debt.

Approximate yield to maturity and cost of debt

8. Russell Container Corporation has a $1,000 par value bond outstanding with 20 years to maturity. The bond carries an annual interest payment of $95 and is currently selling for $920 per bond. Russell Corp. is in a 25 percent tax bracket. The firm wishes to know what the aftertax cost of a new bond issue is likely to be. The yield to maturity on the new issue will be the same as the yield to maturity on the old issue because the risk and maturity date will be similar.
   a. Compute the approximate yield to maturity (Formula 11–1) on the old issue and use this as the yield for the new issue.
   b. Make the appropriate tax adjustment to determine the aftertax cost of debt.

Changing rates and cost of debt

9. For Russell Container Corporation, described in problem 8, assume that the yield on the bonds goes up by 1 percentage point and that the tax rate is now 35 percent.
   a. What is the new aftertax cost of debt?
   b. Has the aftertax cost of debt gone up or down from problem 8? Explain why.

Real-world example and cost of debt

10. MediaOne Group is planning to issue debt that will mature in the year 2027. In many respects the issue is similar to currently outstanding debt of the corporation. Using Table 11–2 on page 330, identify:
    a. The yield to maturity on similarly outstanding debt for the firm, in terms of maturity.

Optimal Capital Structure—Weighting Costs

Having established the techniques for computing the cost of the various elements in the capital structure, we must now discuss methods of assigning weights to these costs. We will attempt to weight capital components in accordance with our desire to achieve a minimum overall cost of capital. This represents an **optimum capital structure**. For the purpose of this discussion, Table 11–1 (Cost of Capital for the Baker Corporation) is reproduced.

		Cost (aftertax)	Weights	Weighted Cost
Debt	K_d	7.05%	30%	2.12%
Preferred stock	K_p	10.94	10	1.09
Common equity (retained earnings)	K_e	12.00	60	7.20
Weighted average cost of capital	K_a			10.41%

How does the firm decide on the appropriate weights for debt, preferred stock, and common stock financing? Though debt is the cheapest form of financing, it should be used only within reasonable limits. In the Baker Corporation example, debt carried an aftertax cost of 7.05 percent, while other sources of financing cost at least 10.94 percent. Why not use more debt? The answer is that the use of debt beyond a reasonable point may greatly increase the firm's financial risk and thereby drive up the costs of all sources of financing.

Assume you are going to start your own company and are considering three different capital structures. For ease of presentation, only debt and equity (common stock) are being considered. The costs of the components in the capital structure change each time we vary the debt-assets mix (weights).

	Cost (aftertax)	Weights	Weighted Cost
Financial Plan A:			
Debt	6.5%	20%	1.3%
Equity	12.0	80	9.6
			10.9%
Financial Plan B:			
Debt	7.0%	40%	2.8%
Equity	12.5	60	7.5
			10.3%
Financial Plan C:			
Debt	9.0%	60%	5.4%
Equity	15.0	40	6.0
			11.4%

The firm is able to initially reduce the **weighted average cost of capital** with debt financing, but beyond Plan B the continued use of debt becomes unattractive and greatly increases the costs of the sources of financing. Traditional financial theory maintains that there is a U-shaped cost-of-capital curve relative to debt utilization by the firm, as illustrated in Figure 11–1. In this example, the optimum capital structure occurs at a 40 percent debt-to-assets ratio.

Most firms are able to use 30 to 50 percent debt in their capital structure without exceeding norms acceptable to creditors and investors. Distinctions should be made,

Assume the firm is preparing to issue new debt. To determine the likely cost of the new debt in the marketplace, the firm will compute the yield on its currently outstanding debt. This is not the rate at which the old debt was issued, but the rate that investors are demanding today. Assume the debt issue pays $101.50 per year in interest, has a 20-year life, and is currently selling for $940. To find the current yield to maturity on the debt, we could use the trial and error process described in the previous chapter. That is, we would experiment with discount rates until we found the rate that would equate the current bond price of $940 with interest payments of $101.50 for 20 years and a maturity payment of $1,000. A simpler process would be to use Formula 10–2, which gives us the approximate yield to maturity. We reproduce the formula below and relabel it Formula 11–1.

$$\text{Approximate yield to maturity } (Y') = \frac{\text{Annual interest payment} + \dfrac{\text{Principal payment} - \text{Price of the bond}}{\text{Number of years to maturity}}}{.6(\text{Price of the bond}) + .4(\text{Principal payment})} \qquad (11\text{–}1)$$

For the bond under discussion, the approximate yield to maturity (Y′) would be:

$$Y' = \frac{\$101.50 + \dfrac{\$1{,}000 - \$940}{20}}{.6(\$940) + .4(\$1{,}000)}$$

$$= \frac{\$101.50 + \dfrac{60}{20}}{\$564 + \$400}$$

$$Y' = \frac{\$101.50 + 3}{\$964} = \frac{\$104.50}{\$964} = 10.84\%$$

In many cases you will not have to compute the yield to maturity. It will simply be given to you. The practicing corporate financial manager also can normally consult a source such as *Standard & Poor's Bond Guide* to determine the yield to maturity on the firm's outstanding debt. An excerpt from this bond guide is presented in Table 11–2 on page 330. If the firm involved is MediaOne Group, for example, the financial manager could observe that debt maturing in 2032 would have a yield to maturity of 7.41 percent as shown in the last column of the table.

Once the bond yield is determined through the formula or the tables (or is given to you), you must adjust the yield for tax considerations. Yield to maturity indicates how much the corporation has to pay on a *before-tax* basis. But keep in mind the interest payment on debt is a tax-deductible expense. Since interest is tax-deductible, its true cost is less than its stated cost because the government is picking up part of the tab by allowing the firm to pay less taxes. The aftertax cost of debt is actually the yield to maturity times one minus the tax rate.[1] This is presented as Formula 11–2 below Table 11–2.

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[1] The yield may also be thought of as representing the interest cost to the firm after considering all selling and distribution costs, though no explicit representation is given above to these costs in relationship to debt. These costs are usually quite small, and they are often bypassed entirely in some types of loans. For those who wish to explicitly include this factor in Formula 11–2, we would have:

$$K_d = [\text{Yield}/(1 - \text{Distribution costs})]\,(1 - T)$$