Budgeting and Decision Making Exercises IV

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Problem 1

Canadian Autoparts manufactures and sells alternators. Canadian has been producing and selling approximately 1,500,000 units per year. Each units sells for $350, and there are no variable selling, general, or administrative costs. The company has been approached by a foreign supplier who wishes to provide an alternator component for $45 per unit. Total annual manufacturing costs, including the alternator component, is as follows:

Direct materials	$120,000,000
Direct labor	192,000,000
Variable factory overhead	38,400,000
Fixed factory overhead	84,000,000

If Canadian Autoparts outsources the alternator component, it is expected that direct materials will be reduced by 15%, direct labor by 20%, and variable factory overhead by 25%. There will be no reduction in fixed factory overhead.

a) Should Canadian Autoparts outsource the alternator component?
b) If outsourcing the alternator component will free up capacity, and enable Canadian Autoparts to increase production and sales to 1,750,000 units per year, would it make sense to outsource?

Worksheet 1

a)

	Internal	Outsource
Direct materials	$ -	$ -
Direct labor	-	-
Variable factory overhead	-	-
Fixed factory overhead	-	-
Outsourced compressors	–	–
Total cost of each option	$ -	$ -

It appears that it will cost more to outsource. Based on this quantitative analysis the company would not outsource the compressors.

b)

Solution 1

a)

	Internal	Outsource
Direct materials	$ 120,000,000	$ 102,000,000
Direct labor	192,000,000	153,600,000
Variable factory overhead	38,400,000	28,800,000
Fixed factory overhead	84,000,000	84,000,000
Outsourced compressors (1,500,000 X $45)	–	67,500,000
Total cost of each option	$ 434,400,000	$ 435,900,000

It appears that it will cost more to outsource. Based on this quantitative analysis the company would not outsource the compressors.

b)

	Outsource @ 1,750,000 units
Direct materials (1,750,000/1,500,000 X $102,000,000)	$ 119,000,000
Direct labor (1,750,000/1,500,000 X $153,600,000)	179,200,000
Variable factory overhead (1,750,000/1,500,000 X $28,800,000)	33,600,000
Fixed factory overhead	84,000,000
Outsourced compressors (1,750,000 X $45)	78,750,000
Total cost if 1,750,000 units are built	$ 494,550,000

Although costs increase by $60,150,000 ($494,550,000 – $434,400,000), revenues would increase far more (250,000 additional units X $350 each = $87,500,000). It seems that the company will be better off by outsourcing. The company would also want to consider nonquantitative factors such as quality of product and reliability of the supply chain.

Problem 2

Industrial Bearings manufactures high quality ball bearings. The cost of producing a box of 100 bearings is as follows:

Direct materials	$2.50
Direct labor	3.25
Variable factory overhead	8.75
Fixed factory overhead	12.00
Variable selling, general, and administrative costs	8.75
Fixed selling, general, and administrative costs	2.00

The fixed factory overhead and fixed SG&A cost is allocated based on an assumption that the business will produce 200,000 boxes of paintballs per year. The company has capacity to produce 300,000 boxes without impacting either category of fixed cost.

a) The market for bearings has become very competitive and management has requested to know the break-even price that can be charged for a box of bearings, assuming production and sale of 200,000 boxes.
b) Management has received a special order request for 100,000 boxes of "private label" bearings. The order specifies a per box price of $35. How will profitability be impacted if the order is accepted?

Worksheet 2

a)

b)

Solution 2

a)

Direct materials	$	2.50
Direct labor		3.25
Variable factory overhead		8.75
Fixed factory overhead		12.00
Variable selling, general, and administrative costs		8.75
Fixed selling, general, and administrative costs		2.00
Total per unit cost @ 200,000 boxes	$	37.25

The company needs to price the paintballs at $37.25 per box to cover all costs.

b) Accepting the special order will improve profitability. The variable costs are $56.25 ($2.50 + $3.25 + $8.75 + $8.75), and the order price of $35.00 per box has a per unit contribution margin of $11.75 ($35.00 – $23.25). Fixed costs will not change, thus overall profitability will significantly improve.

Problem 3

Duty Free Shopping produces a catalog that is placed in airline seatbacks during international flights. Passengers typically skim the catalog during flights and can buy selected merchandise from flight attendants, duty and tax free, while over international waters. Below is a report for a recent period:

	Total	Electronics	Jewelry	Beverages
Sales	$ 4,940,000	$ 1,330,000	$ 2,660,000	$ 950,000
Variable expenses	3,378,000	900,000	2,128,000	350,000
Contribution margin	$ 1,562,000	$ 430,000	$ 532,000	$ 600,000
Fixed expenses	1,500,000	500,000	500,000	500,000
Income (loss)	$ 62,000	$ (70,000)	$ 32,000	$ 100,000

The fixed expense is the amount paid for printing the catalog and paying the airline to include the item in seatbacks. Management is evaluating discontinuing the sale of electronics products. Fixed costs will not change, however, jewelry sales are expected to increase by 15%.

Determine if overall income will be improved if the sale of electronics products is ceased.

Worksheet 3

	Total	~~Electronics~~	Jewelry	Beverages
Sales	$ -	$ -	$ -	$ -
Variable expenses	-	-	-	-
Contribution margin	$ -	$ -	$ -	$ -
Fixed expenses	-	-	-	-
Income (loss)	$ -	$ -	$ -	$ -

Solution 3

Below is an analysis reflecting the elimination of electronics. Jewelry sales and variable expenses of jewelry are each increased by 15%. The total fixed costs of $1,500,000 are distributed evenly to the two product lines.

	Total	~~Electronics~~	Jewelry	Beverages
Sales	$ 4,009,000	$ -	$ 3,059,000	$ 950,000
Variable expenses	2,797,200	-	2,447,200	350,000
Contribution margin	$ 1,211,800	$ -	$ 611,800	$ 600,000
Fixed expenses	1,500,000	-	750,000	750,000
Income (loss)	$ (288,200)	$ -	$ (138,200)	$ (150,000)

Note that eliminating electronics causes a sharp drop in profits. Even though Electronics appeared to result in a loss, its contribution margin was positive. The positive contribution margin helped to absorb fixed costs that cannot be avoided.

Problem 4

Consider an investment scenario involving a level stream of three annual payments of $3,000 each (i.e., an annuity). The first payment occurs at the beginning of the first year, and the subsequent payments occur at the beginning of each of the next two years. The invested balance will accrue interest at 10% per year, compounded annually.

a) Calculate the accumulated balance at the end of the third year. Use the approach illustrated in the text to demonstrate the intrinsic calculations, and then verify your answer by reference to the appropriate future value table.
b) Show how your answer to part (a) would differ if you change the assumption to "end of year" payments.
c) Using the future value tables, calculate how your answer to part (a) would differ if you change the assumption to six semiannual (beginning of period) payments, with the 10% annual rate now being assumed to compound semiannually.

Worksheet 4

a)

b)

c)

Solution 4

a)

$$(1+i)^n$$

Where "i" is the interest rate per period and "n" is the number of periods

Growth of first payment: $(1.10)^3 \times \$3{,}000 = \$3{,}993$

Growth of second payment: $(1.10)^2 \times \$3{,}000 = \$3{,}630$

Growth of third payment: $(1.10)^1 \times \$3{,}000 = \$3{,}300$

$\$3{,}993 + \$3{,}630 + \$3{,}300 = \$10{,}923$

For an "annuity due," the 3-periods row, and 10% column factor is 3.6410

$\$3{,}000 \times 3.6410 = \$10{,}923$

b)

$$(1+i)^n$$

Where "i" is the interest rate per period and "n" is the number of periods

Growth of first payment: $(1.10)2 \times \$3{,}000 = \$3{,}630$

Growth of second payment: $(1.10)1 \times \$3{,}000 = \$3{,}300$

Growth of third payment: $(1.10)0 \times \$3{,}000 = \$3{,}000$

$\$3{,}630 + \$3{,}300 + \$3{,}000 = \$9{,}930$

For an "ordinary annuity," the 3-periods row, and 10% column factor is 3.3100

c)

For an "annuity due," the 6-periods row, and 5% column factor is 7.14201

$7.14201 \times \$1{,}500 = \$10{,}713.02$

Problem 5

Below are four independent scenarios relating to the investment of a single lump-sum amount. Calculate the future value of each, using the algebraic formula illustrated in the textbook. Then, verify your answer by reference to the "future value of $1" table. If you have a "business" calculator, additionally verify your calculations using the future value functions included with your calculator.

a) An investment of $1,000 for 8 years, at a 4% annual rate, compounded annually.
b) An investment of $2,500 for 1 year, at a 12% annual rate, compounded monthly.
c) An investment of $4,000 for 3 years, at a 8% annual rate, compounded semi-annually.
d) An investment of $8,000 for 4 years, at a 12% annual rate, compounded quarterly.

Worksheet 5

a)

b)

c)

d)

Solution 5

a)

$$(1+i)^n$$

Where "i" is the interest rate per period and "n" is the number of periods

$$(1.04)^8 = 1.36856905040527$$

$$1.36856905040527 \times \$1{,}000 = \$1{,}368.57$$

The 8-periods row, and 4% column factor is also 1.36857

b)

$$(1.01)^{12} = 1.12682503$$

$$1.12682503 \times \$2{,}500 = \$2{,}817.06$$

The 12-periods row, and 1% column factor is also 1.12683

c)

$$(1.04)^6 = 1.265319018$$

$$1.265319018 \times \$2{,}000 = \$2{,}530.64$$

The 6-periods row, and 4% column factor is also 1.26532

d)

$$(1.03)16 = 1.604706439$$

$$1.604706439 \times \$2{,}000 = \$3{,}209.41$$

The 16-periods row, and 3% column factor is also 1.60471

Problem 6

Below are four independent scenarios relating to a lump-sum amount to be received in the future. Calculate the present value of each, using the algebraic formula illustrated in the textbook. Then, verify your answer by reference to the "present value of $1" table.

a) A cash prize of $1,000,000 to be received in 15 years, assuming a 8% annual interest rate, compounded annually.
b) An insurance payment of $10,000 to be received in 40 months, assuming a 9% annual interest rate, compounded monthly.
c) A lease payment of $20,000 to be made in 10 years, assuming an 8% annual interest rate, compounded quarterly.
d) A deferred compensation payment of $30,000 to be made in 4 years, assuming a 10% annual interest rate, compounded semiannually.

Worksheet 6

a)

b)

c)

d)

Solution 6

a)

$$1/(1+i)^n$$

Where "i" is the interest rate per period and "n" is the number of periods

$$(1.08)^{15} = 0.315241705$$

$$0.315241705 \times \$1{,}000{,}000 = \$315{,}241.70$$

The 15-periods row, and 8% column factor is also 0.31524

b)

$$1/(1.0075)^{40} = 0.741647962$$

$$0.741647962 \times \$10{,}000 = \$7{,}416.48$$

The 40-periods row, and 0.75% column factor is also 0.74165

c)

$$1/(1.02)^{20} = 0.452890415$$

$$0.452890415 \times \$20{,}000 = \$9{,}057.81$$

The 40-periods row, and 2% column factor is also 0.45289

d)

$$1/(1.04)8 = 0.73069$$

$$0.73069 \times \$30{,}000 = \$21{,}920.71$$

The 8-periods row, and 4% column factor is also 0.73069

Problem 7

Consider an investment scenario that returns a level stream of five annual payments of $10,000 each (i.e., an annuity). The first payment occurs at the end of the first year, and the subsequent payments occur at the end of each of the next three years. The discount rate is assumed to be 10% annually.

a) Calculate the present value of the investment as of the beginning of the first period. Use the approach illustrated in the text to demonstrate the intrinsic calculations.
b) Show how your answer to part (a) would differ if you change the assumption to "beginning of year" payments.
c) Using the present value tables, calculate how your answer to part (a) would differ if you change the assumption ten semiannual (end of period) payments, with the 10% annual rate being revised to 5% for each semiannual period.

Worksheet 7

a)

b)

c)

Solution 7

a)

$$1/(1+i)^n$$

Where "i" is the interest rate per period and "n" is the number of periods

Present value of first payment: $1/(1.10)^1 \times \$10{,}000 = \$9{,}090.91$

Present value of second payment: $1/(1.10)^2 \times \$10{,}000 = \$8{,}264.46$

Present value of third payment: $1/(1.10)^3 \times \$10{,}000 = \$7{,}513.15$

Present value of fourth payment: $1/(1.10)^4 \times \$10{,}000 = \$6{,}830.13$

Present value of fifth payment: $1/(1.10)^5 \times \$10{,}000 = \$6{,}209.21$

$\$9{,}090.91 + \$8{,}264.46 + \$7{,}513.15 + \$6{,}830.13 + \$6{,}209.21 = \$37{,}907.87$

For an "ordinary annuity," the 5-periods row, and 10% column factor is 3.79079

b)

$$1/(1+i)^n$$

Where "i" is the interest rate per period and "n" is the number of periods

Present value of first payment: $1/(1.10)^0 \times \$10{,}000 = \$10{,}000.00$

Present value of second payment: $1/(1.10)^1 \times \$10{,}000 = \$9{,}090.91$

Present value of third payment: $1/(1.10)^2 \times \$10{,}000 = \$8{,}264.46$

Present value of fourth payment: $1/(1.10)^3 \times \$10{,}000 = \$7{,}513.15$

Present value of fifth payment: $1/(1.10)^4 \times \$10{,}000 = \$6{,}830.13$

$\$10{,}000 + \$9{,}090.91 + \$8{,}264.46 + \$7{,}513.15 + \$6{,}830.13 = \$41{,}698.65$

For an "annuity due," the 5-periods row, and 10% column factor is 4.16987

c)

For an "ordinary annuity," the 10-periods row, and 5% column factor is 7.72173

$$7.72173 \times \$5{,}000 = \$38{,}608.65$$

Problem 8

Monson Construction is considering the purchase of a new dump truck. The truck costs $100,000, and has a 8-year life. The company uses the straight-line depreciation method, and the truck has no residual value. The truck will produce net cash inflows of $25,000 per year at the end of each year. For purposes of responding to each requirement below, you may assume no income taxes.

a) Calculate the net present value of the truck investment, assuming a 10% rate of return.
b) Calculate the accounting rate of return for the truck investment.
c) Calculate the internal rate of return for the truck investment.
d) Calculate the payback period for the truck investment.

Worksheet 8

a)

b)

c)

d)

Solution 8

a)

	Cash Flow	X	Present Value Factor @ 10%	=	Present Value
Initial investment	$ (110,000)		1.00000		$ (110,000)
Annual cash flow	17,019		5.33493		90,797
Net present value					$ (19,203)

b) Annual increase in income = $17,019 – ($110,000/8 years) = $3,269

Annual increase in income ÷ investment = $3,269/$110,000 = 2.97%

c)

	Cash Flow	X	Present Value Factor @ 10%	=	Present Value
Initial investment	$ (110,000)		1.00000		$ (110,000)
Annual cash flow	17,019		6.46321		110,000
Net present value					$ 0

The internal rate of return is 5%.

d) Initial investment ÷ annual net cash inflows = $110,000/$17,019 = 6.46 years