4-3

*P* = *A*(*P*/*A*, 3.5%, *n*)

$1,000 = $50 (*P*/*A*, 3.5%, *n*)

(*P*/*A*, 3.5%, *n*) = 20

From the 3.5% interest table: *n* = 35

4-8

Let X = toll per vehicle.

Then:

*A* = 20,000,000 X *i* = 10%

*F* = $25,000,000 *n* = 3

20,000,000 X (*F*/*A*, 10%, 3) = $25,000,000

20,000,000 X (3.31) = $25,000,000

X = $0.38 per vehicle

4-23

20thBirthday

59th Birthday

F

$1 x 106 @ 60th Birthday

i = 15%

Number of yearly investments = (59 – 20 + 1) = 40

The diagram indicates that the problem is not in the form of the uniform series compound amount factor. Thus, find *F* that is equivalent to $1,000,000 one year hence:

*F* = $1,000,000 (*P*/*F*, 15%, 1) = $1,000,000 (0.8696)

= $869,600

*A* = $869,600 (*A*/*F*, 15%, 40) = $869,600 (0.00056)

= $486.98

This result is very sensitive to the sinking fund factor. To three significant figures, (*A*/*F*, 15%, 40) is actually 0.000562 which makes *A* = $488.71.

4-30

*A* = $6,000

*A* = ?

*A* = $40,000

*x*

To have sufficient money to pay the four $40,000 disbursements,

*x* = $40,000 (*P*/*A*, 5%, 4) = $40,000 (3.546)

= $141,840

This $141,840 must be accumulated by the two series of deposits.

The four $6,000 deposits will accumulate by *x* (17th birthday):

*F* = $6,000 (*F*/*A*, 5%, 4) (*F*/*P*, 5%, 10)

= $6,000 (4.310) (1.629)

= $42,125.90

Thus, the annual deposits between 8 and 17 must accumulate a future sum:

= $141,840 − $42,125.90

= $99,714.10

The series of ten deposits must be:

*A* = $99,714.10 (*A*/*F*, 5%, 10) = $99,714.10 (0.0745)

= $7,927.30

4-46

P

$100

$150

$200

$250

*P* = $100 + $150 (*P/A,* 10%, 3) + $50 (*P/G,* 10%, 3)

= $100 + $150 (2.487) + $50 (2.329)

= $589.50

4-50

D D D D

P

0

$100

$200

$300

Present Worth of gradient series:

*P* = $100 (*P*/*G*, 10%, 4) = $100 (4.378) = $437.80

*D* = $437.80 (*A*/*F*, 10%, 4) = $4.7.80 (0.2155) = $94.35

4-57

This problem has a declining gradient.

P = $85,000 (*P*/*A*, 4%, 5) − $10,000 (*P*/*G*, 4%, 5)

= $85,000 (4.452) − $10,000 (8.555)

= $292,870

4-69

1. P = 20,000 (*P*/*A*, 8%, 10) + 2,000 (*P*/*G*, 8%, 10)

= (20,000) (6.710) + (2,000) (25.977)

= $186,154

1. P = 20,000 (*P*/*A*, 10%, 8%,10)

= 20,000 

= $201,405

4-75

P

F

$1,500

1. Since the book only gives a geometric gradient to present worth factor, we must first solve for P and then F.

*P* = ? *n* = 6 *i* = 10% *g* = 8%

P = A1 (*P*/*A*, *g*%, *i*%, *n*)

(*P*/*A*, *g*%, *i*%, *n*) = [(1 − (1 + *g*)*n* (1 + *i*)−*n*)/(*i* − *g*)]

= [(1 − (1.08)6 (1.10)−6)/(0.10 − 0.08)]

= 5.212

P = $1,500 (5.212) = $7,818

F = P (*F*/*P*, *i*%, *n*) = $7,818 (*F*/*P*, 10%, 6) = $13,853

As a check, solve with single payment factors:

$1,500.00 (*F*/*P*, 10%, 5) = $1500.00 (1.611) = $2,413.50

$1,620.00 (*F*/*P*, 10%, 4) = $1,620.00 (1.464) = $2,371.68

$1,749.60 (*F*/*P*, 10%, 3) = $1,749.60 (1.331) = $2,328.72

$1,889.57 (*F*/*P*, 10%, 2) = $1,898.57 (1.210) = $2,286.38

$2,040.73 (*F*/*P*, 10%, 1) = $2,040.73 (1.100) = $2,244.80

$2,203.99 (*F*/*P*, 10%, 0) = $2,203.99 (1.000) = $2,203.99

Total Amount = $13,852.07

1. Here, i% = g%, hence the geometric gradient to present worth equation is:

P = A1 n (1 + *i*)−1 = $1,500 (6) (1.08)−1 = $8,333

F = P (F/P, 8%, 6) = $8,333 (1.587) = $13,224

4-81

Personnel savings from use of robot:

PW = $58,240 [1 – (1 + 0.06)10 (1 + 0.15)–10] / (0.15 – 0.06)

PW = $58,240 (6.1926) = $360,654

Cost of robot:

PW = $75,000 + $16,500(*P*/*A*, 15%,10) + $1,500(*P*/*G*,15%,10) – $5,000(*P*/*F*,15%,10)

PW = $75,000 + $16,500(5.019) + $1,500(16.979) – $5,000(.2472)

PW = $182,046

The robot is the cheaper alternative.

4-96

*i* = interest rate/interest period = 0.13/52 = 0.0025 = 0.25%

Paco’s Account: 63 deposits of $38,000 each, equivalent weekly deposit

n = 13

i = ¼%

A = ?

$38,000

…………

*A* = *F* (*A*/*F*, *i*%, *n*)

= $38,000 (*A*/*F*, 0.25%, 13)

= $38,000 (0.0758)

= $2,880.40

For 63 deposits:

*F* = $2,880.40 (*F*/*A*, 0.25%, 63×13)

= $2,880.40 [((1.0025)819 − 1)/0.0025]

= $2,880.40 (2691.49)

= $7,752,570 at 4/1/2012

Amount at 1/1/2017 = $7,742,570 (*P*/*F*, 0.25%, 273)

= $7,742,570 (0.50578)

= $3,921,000

Tisha’s Account: 18 deposits of $18,000 each

Equivalent weekly deposit:

A = $18,000 (*A*/*F*, 0.25%, 26)

= $18,000 (0.0373)

= $671.40

Present Worth P1/1/2016 = $671.40 (*P*/*A*, 0.25%, 18×26)

= $671.40 [((1.0025)468 − 1)/275.67]

= $185,084

Amount at 1/1/2017 = $185,084 (*F*/*P*, 0.25%, 52)

= $185,084 (1.139)

= $211,000

Sum of both accounts at 1/1/2017 = $3,921,000 + $211,000 = $4,132,000

4-115

1. *P* = $1,000 *A* = $90.30 *i* = ? *m* = 12 months

$1,000 = $90.30 (*P*/*A*, *i*%, 12)

(*P*/*A*, *i*%, 12) = $1,000/$90.30 = 11.074

*i* = 1.25%

1. *r* = (1.25%) (12)

= 15%

1. *i*a = (1 + 0.0125)12 − 1

= 16.08%