Solution to Question Book for

Investment Criteria and Decision

ST-1 a. **Payback:**

To determine the payback, construct the cumulative cash flows for each project as follows.

	Cumulative Cash Flows	
Year	Project X	Project Y
0	–$10,000	–$10,000
1	–3,500	–6,500
2	–500	–3,000
3	2,500	500
4	3,500	4,000

$$\text{Payback}_X = 2 + \frac{\$500}{\$3,000} = 2.17 \text{ years}$$

$$\text{Payback}_Y = 2 + \frac{\$3,000}{\$3,500} = 2.86 \text{ years}$$

Net present value (NPV):

$$NPV_X = -\$10,000 + \frac{\$6,500}{(1.12)^1} + \frac{\$3,000}{(1.12)^2} + \frac{\$3,000}{(1.12)^3} + \frac{\$1,000}{(1.12)^4} = \$966.01$$

$$NPV_Y = -\$10,000 + \frac{\$3,500}{(1.12)^1} + \frac{\$3,500}{(1.12)^2} + \frac{\$3,500}{(1.12)^3} + \frac{\$3,500}{(1.12)^4} = \$630.72$$

Alternatively, using a financial calculator, input the cash flows into the cash flow register, enter I/YR = 12, and then press the NPV key to obtain NPV_X = $966.01 and NPV_Y = $630.72.

Internal rate of return (IRR):

To solve for each project's IRR, find the discount rates that equate each NPV to zero:

$$IRR_X = 18.0\%$$
$$IRR_Y = 15.0\%$$

Modified Internal Rate of Return (MIRR):

To obtain each project's MIRR, begin by finding each project's terminal value (TV) of cash inflows:

$$TV_X = \$6,500(1.12)^3 + \$3,000(1.12)^2 + \$3,000(1.12)^1 + \$1,000 = \$17,255.23$$

$$TV_Y = \$3,500(1.12)^3 + \$3,500(1.12)^2 + \$3,500(1.12)^1 + \$3,500 = \$16,727.65$$

Now, each project's MIRR is the discount rate that equates the PV of the TV to each project's cost, $10,000:

$$MIRR_X = 14.61\%$$
$$MIRR_Y = 13.73\%$$

Profitability index (PI):
To obtain each project's PI, divide its present value of future cash flows by its initial cost. The PV of future cash flows can be found from the NPV calculated earlier:

$$PV_X = NPV_X + \text{Cost of X} = \$966.01 + \$10{,}000 = \$10{,}966.01$$
$$PV_Y = NPV_Y + \text{Cost of Y} = \$630.72 + \$10{,}000 = \$10{,}630.72$$
$$PI_X = PV_X/\text{Cost of X} = \$10{,}966.01/\$10{,}000 = 1.097$$
$$PI_Y = PV_Y/\text{Cost of Y} = \$10{,}630.72/\$10{,}000 = 1.063$$

10-1 NPV = $7,486.68.
10-2 IRR = 16%.
10-3 MIRR = 13.89%.
10-4 PI = 1.14.
10-5 4.34 years.
10-6 6.51 years.
10-7 5%: NPV_A = $16;108;952;
NPV_B = $18;300;939:
10%: NPV_A = $12;836;213;
NPV_B = $15;954;170:
15%: NPV_A = $10;059;587;
NPV_B = $13;897;838:
10-8 NPV_T=$409; IRR_T=15%;
$MIRR_T$ = 14.54%; Accept.
NPV_P = $3,318;
IRR_P = 20%;
$MIRR_P$ = 17.19%; Accept.
10-9 NPV_E = $3,861;
IRR_E = 18%;
NPV_G = $3,057;
IRR_G = 18%;
Purchase electric-powered forklift, since it has a higher NPV.
10-10 NPV_S = $814.33;
NPV_L = $1,675.34;
IRR_S = 15.24%;
IRR_L = 14.67%;
$MIRR_S$ = 13.77%;
$MIRR_L$ = 13.46%;
PI_S = 1.081; PI_L = 1.067.
10-11 MIRRX = 13.59%;
MIRRY = 13.10%.
10-12 a. NPV = $136,578;
IRR = 19.22%.
10-13 b. IRR_A = 18.1%;
IRR_B = 24.0%.
c. 10%: PV_A = $283.34;
NPV_B = $178.60.
17%: PV_A = $31.05;
NPV_B = $75.95.
d. (1) $MIRR_A$ = 14.07%;
$MIRR_B$ = 15.89%.
(2) $MIRR_A$ = 17.57%;
$MIRR_B$ = 19.91%.
10-14 a. $0; −$10,250,000; $1,750,000.
b. 16.07%.
10-15 a. NPV_A = $18,108,510;
NPV_B = $13,946,117;
IRR_A= 15.03%;
IRR_B = 22.26%.
b. NPV_Δ = $4,162,393;
IRR_Δ = 11.71%.
10-16 Extended NPV_A = $12.76 million;
Extended NPV_B = $9.26 million.
EAA_A = $2.26 million;
EAA_B = $1.64 million.
10-17 Extended NPV_A = $4.51 million.
EAA_A = $0.85 million;
EAA_B = $0.69 million.
10-18 NPV of 360-6 = $22,256.
Extended NPV of 190-3 = $20,070.
EAA of 360-6 = $5,723.30;
EAA of 190-3 = $5,161.02.
10-19 d. 7.61%; 15.58%.
10-20 a. Undefined.
b. NPV_C = −$911,067;
NPV_F = −$838,834.
10-21 a. A = 2.67 years;
B = 1.5 years.
b. A = 3.07 years;
B = 1.825 years.
c. NPV_A = $12,739,908;
Choose both.
d. NPV_A = $18,243,813;
Choose A.
e. NPV_B = $8,643,390;
Choose B.
f. 13.53%.
g. $MIRR_A$ = 21.93%;
$MIRR_B$ = 20.96%.
10-22 a. 3 years.
b. No.