Check Your Progress –1

1. a) Capital investment is not necessarily an investment in tangible assets. □ T □ F
   b) All investment are expected to yield inflows. □ T □ F
   c) A comparison of the investment and the returns cannot be made unless all monetary amounts are stated on the same time basis. □ T □ F
   d) The net amount invested in the new machine is the cost of the new machine minus the net amount received from the sale of old machine. □ T □ F
   e) Total working capital that must be held to support the investment is a part of the total investment in an asset. □ T □ F
   f) Depreciation on the asset is included as a cost in computing DCF returns □ T □ F
   g) The networking capital released on the termination of a project is not a return (or inflow) of the final year. □ T □ F
   h) The cost incurred in the past have no bearing on the decisions to be made in future. □ T □ F
2. Western Europe Company is considering the replacement of one of its machines with a newer model which supposedly will reduce the operating cost considerably. The company prepared the following analysis.

	Old Machine	**New Machine**
Depreciation	$ 10, 000	$ 18, 000
Labor	12, 000	6, 000
Other costs	10, 000	4, 000
Total costs	32, 000	28, 000

The old machine costs $ 80, 000 and has been operated for three years out of an estimated eight-year life. The new machine, which has an estimated life of five years, can be acquired for $ 90,000 less a trade in allowance of $ 20, 000 for the old machine. The other costs listed above consists of repairs, power, lubrication and others.

Which of the following statements is False

a) Depreciation on old machine is a sunk cost.
b) Depreciation on the old machine may be disregarded in deciding whether to replace the old machine.
c) Labor and other costs are out-of-pocket costs.
d) The payback period of the new machine is seven and one-half years.

5.6 PROBLEMS AND SOLUTIONS

EX: 1 The expected cash flows of a project are as followed

Year	**Cash flows**
0	$ 100, 000
1	20, 000
2	30, 000
3	40, 000
4	50, 000
5	30, 000

The cost of capital is 12 percent calculate the following

a) Payback period
b) Discounted payback period
c) Net present value
d) Profitability index
e) Internal rate of return

Solution:

Year	**Cash flow**	**PV factor**	**PV**	**cash flow**	**Cumulative**
0	$ -100, 000	.12%			
1	20, 000	.893	17, 860	82, 140	
2	30, 000	.797	23, 910	58, 230	
3	40, 000	.712	28, 480	29, 750	
4	50, 000	.636	31, 800		
5.	30, 000	.567	17, 010		
			119, 060		
			-100, 000		

c) Net present value = 19, 060

d) Profitability Index = 119, 060 / 100, 000 = 1.19

a) $P = E + \frac{B}{C} = 3 + \frac{10,000}{50,000} = 3.2$

b) $= 3 + \frac{29,750}{31,800}$ = Apr. 4

e)		IRR	18%		IRR	19%	
1	20, 000		.847	16,940		.846	16,920
2	30, 000		.718	21,540		.706	21,180
3	40, 000		.609	24,360		.593	23,720
4	50, 000		.516	25,800		.499	25,800
5	30, 000		.437	13,110		.419	12,570
				101,750			100,190

$IRR = LRD + \frac{NPVL}{PV} \times R \quad = 18 + \frac{1,750}{2,530} \times 1 \quad = 18.69$

EX: 2 An equipment A, has cost of $ 75, 000 and cash inflow of $ 20, 000 a year for six years. A substitute equipment B would cost $ 50, 000 and cash flow $ 14, 000 per year for six years. The required rate of return for both projects is 11%. Calculate NPU and IRR for each equipment which equipment should be accepted?

Equipment A

NPV = 20, 000 (ACF_6 .11) – 75, 000
= 20, 000 (4.231) – 75, 000
= 84, 620 – 75, 000
= 9, 620

Pay back period $= \frac{75,000}{20,000}$
= 3.75

From present value annuity table 3.75 is between
$PVAF_{15} = 3.784$
$PVAF_{16} = 3.685$

$IRR = r - \frac{PB - DFr}{DFrL - DFrH}$

$IRR = 15 - \frac{3.75 - 3.784}{(3.784 - 3.685)}$

$= 15 - \frac{-0.034}{0.099}$

= 15.34%

Equipment B

NPV = 14, 000 (ACF6 .11) - 50, 000
= 14, 000 (4.231) – 50, 000
= 59, 234 – 50, 000
= 9, 234

Pay back period $= \frac{50,000}{14,000}$
= 3.571

From present value annuity table 3.571 lies between
$PVAF_6$ 17 = 3.589
$PVAF_6$ 18 = 3.498

$IRR = r - \frac{PB - DFr}{DFrL - DFrH}$

$= 17 - \frac{3.571 - 3.589}{(3.589 - 3.498)}$

$= 17 - \frac{-0.18}{0.09}$

= 17 + .002
= 17.20

Equipment A has more NPV but lower IRR than B. A should be preferred because it will increase the wealth of shareholders.

EX: 3

A company is faced with the problem of choosing between two mutually exclusive projects. Project A requires a cash outlay of $100, 000 and cash running expenses of $35, 000 per year. On the other hand project B will cost $150, 000 and requires cash running expenses of $20,000 per annum. Both the machines have eight years life. Project A has $4, 000 salvage value and project B has $14, 000 salvage value. The company's tax rate is 50 percent and has 10 percent required rate of return. Assume depreciation straight-line basis and no tax on salvage value of assets. Which project should be accepted?

	A	B
Cost	100, 000	150, 000
Exp.	35, 000	20, 000
Cost	B – A = 50, 000	
Expenses	B – A = 15, 000 saving	

Depreciation	100, 000 ÷ 8	150, 000 ÷ 8
	12, 500	18, 750
	(14, 000 – 4,000) =	10, 000
Saving		15, 000
- Depreciation		6, 250
Profit before tax		8, 750
Tax 50%		4, 375
		4, 375
		4, 375
Add Depreciation		6, 250
Annual cash flow		10, 625
Terminal salvage value		= 10, 000

(B – A) Net present value = 10, 625 (PVAF8.11) + 10, 000 (PVF8. 11) – 50, 000
= 10, 625 (5.335) + 10, 000 (.467) – 50, 000
= 56, 684 + 4, 670 – 50, 000
= 61, 354 – 50, 000
= 11, 354

Project B may be accepted. It has positive NPV

Ex. 4

Fairwell Company has recorded the following data related to two alternatives A and B. Both require an investment of $ 56, 125

	A	B
Year	ACFs after depre. Tax	ACFs after depre. Tax
1	$ 3, 375	11, 375
2	5, 373	9, 375
3	7, 375	7, 375
4	9, 375	5, 375
5	11, 375	3, 375
	36, 875	36, 875
Cost of Capital	10%	
Estimated life	5 years	5 years
Estimated salvage value	$ 3, 000	$ 3, 000
Tax rate	55%	55%

Depreciation has been charged on straight line basis calculate:

1) ARR 2) Payback period 3) Net present value 4) Profitability Index 5) Internal Rate of Return

$$\text{ARR} = \frac{\textit{Average income}}{\textit{Average investment}} \times 100$$

$$\text{Average income} = \frac{36,875}{5} = 7,375$$

$$\text{Average investment} = \text{Networking capital} + \text{salvage value} + \frac{1}{2}(\text{cost of plant} - \text{salvage value})$$

$$= 3,000 + \frac{1}{2}(56,125 - 3,000) \quad = 3,000 + \frac{1}{2}(53,125) \quad = 3,000 + 26,562.5 \quad = 29,562.5$$

$$\text{ARR for both} = \frac{7,375}{29,562.5} \times 100 \qquad = 24.9\%$$

ARR is same for A and B, because both have same annual incomes. The ARR may be compared to the desired one and if the actual is more, it has to be accepted otherwise it has to be rejected.

2) Pay Back Period:

To calculate payback period we have to add back the depreciation to ACFs after tax and depreciation

	A	**B**
I. Depreciation: Cost	56, 125	56, 125
-Salvage	3, 000	3, 000
	$\frac{53,125}{5}$	$\frac{53,125}{5}$
	10, 625	10, 625

II. Salvage value at the end has to be added to the cash flow

	A			B		
0		56, 125			56, 125	
1	3, 375 + 10, 625	14, 000	42, 125	11, 375 + 10, 625	22, 000	34,125
2	5, 375 + 10, 625	16, 000	26, 125	98, 375 + 10, 625	20, 000	14, 125
3	7, 375 + 10, 625	18, 000	8, 125	7, 375 + 10, 625	18, 000	
4	9, 375 + 10, 625	20, 000		51, 375 + 10, 625	16, 000	
5	11, 375 + 10, 625	25, 000		3, 375 + 10, 625	17, 000	
		+ 3, 000			+ 3, 000	

$$P = 3 + \frac{8,125}{20,000}$$

$$= 3 + 406$$

$$= \underline{3.406}$$

$$P = E + \frac{B}{C}$$

$$2 + \frac{14,125}{18,000}$$

$$2 + 0.785$$

$$\underline{2.785}$$

3. Net present value

	A			B		
Year	**ACF**	**PV Factor**	**Present value**	**ACF**	**PV**	**Factor**
1	$ 14, 000	0.909	12, 726	$ 22, 000	0.909	19, 998
2	16, 000	0.826	13, 216	20, 000	0.826	16, 520
3	18, 000	0.751	13, 518	18, 000	0.751	13, 518
4	20, 000	0.683	14, 660	16, 000	0.683	10, 928
5	25, 000	0.621	15, 525	17, 000	0.621	10, 557
			69, 645			71, 521
- origi. Invest.			56, 125			56, 125
			13, 520			15, 396

Project B has more NPV than A hence, preferred

4. Profitability Index: PI = $\frac{Present\ value\ of\ cash\ inflows}{Present\ value\ of\ cash\ netflows}$ $= \frac{69,645}{56,125}$ $= \frac{71,521}{56,125}$

$= \underline{1.241}$ $= \underline{1.274}$

5. Internal Rati of Return

		17%			20%	
Year	**CFAT**	**PV Factor**	**Present value**	**CFAT**	**PV Factor**	**Present value**
1	$ 14, 000	0.855	11, 970	$ 22, 000	0.833	$ 18, 326
2	16, 000	0.731	11, 696	20, 000	0.694	13, 990
3	18, 000	0.624	11, 232	18, 000	0.579	10, 422
4	20, 000	0.534	10, 680	16, 000	0.484	7, 712
5	25, 000	0.456	11, 400	17, 000	0.442	6, 834
			59, 978			57, 174
	- Orign. Invest.		-56, 125			-56, 125
			853			1049

This is more, let us try higher interest

	A			B		
	18%			**22%**		
Year	**ACF**	**PV Factor**	**Present value**	**ACF**	**PV Factor**	**Present value**
1	$ 14, 000	0.847	$ 11, 858	$ 22, 000	$ 0.820	$ 18, 040
2	16, 000	0.718	11, 488	20, 000	0.672	13, 440
3	18, 000	0.609	10,962	18, 000	0.551	9,918
4	20, 000	0.516	10, 320	16, 000	0.451	7, 216
5	25, 000	0.437	10,928	17, 000	0.370	6, 290
			55,553			54,904
	- Orign. Invest.		-56, 125			-56, 125
			-572			-1,221

IRR = $LRD + \frac{NPVL}{PV} \times R$ $= 17 + \frac{853}{1,425} \text{ x } 1$ $= 20 + \frac{1,049}{2,220} \times 2$

$= 17 + 0.6$ $= 20 + 0.9$

$= 17.6\%$ $= 20.9\%$

Note: A: 853 = 56,978 – 56,125 and 1,425 = 56,978 – 55, 553 B: 1,049 = 57,174 – 56,125 and 2,270 = 57,174 – 54,904

EX: 4. ABC Plc. Has got $ 20, 000 to invest. The following proposals are under consideration

Project	Initial outlay	Annual cash flow	Life Year
A	$ 10, 000	$ 2, 500	5
B	8, 000	2, 600	7
C	4, 000	1, 000	15
D	10, 000	2, 400	20
E	5, 000	1, 125	15
F	6, 000	2, 400	6
G	2, 000	1, 000	2

a) Rank the projects in order of desirability under payback period.
b) Rank these projects under net present value method assuming cost of capital 10%.

a) Payback period

Project	Investment	ACF	Payback period	Rank
A	$ 10, 000	$ 2, 500	4	4
B	8, 000	2, 600	3.1	3
C	4, 000	1, 000	4	4
D	10, 000	2, 400	4.2	5
E	5, 000	1, 125	4.4	6
F	6, 000	2, 400	2.5	2
G	2, 000	1, 000	2	1

	Net	Present value	PV Factor 10%	Present Value	NPV	Rank
A	10,000	$ 2,500	3.791	$ 9,478	-	-
B	8, 000	2, 600	4.868	12, 657	4, 657	2
C	4, 000	1, 000	7.606	7.606	3, 606	4
D	10, 000	2, 400	8.514	20, 434	10, 434	1
E	5, 000	1, 125	7.606	8, 557	3, 557	5
F	6, 000	2, 400	4. 355	10, 452	4, 452	3
G	2, 000	1, 000	1.736	1, 736	-	-

Note: Project A & G result in negative NPV hence, may be rejected.

Ex: 5. A company is considering to purchase a plant. Two plants are available X and Y each costing $ 50, 000. The annual cash flows are expected as below.

	ACFS	
Year	**Plant X**	**Plant Y**
1	$ 15, 000	$ 5, 000
2	20, 000	15, 000
3	25, 000	20, 000
4	15, 000	30, 000
5	10, 000	20, 000

Further information:
a) Depreciation is charged on straight line bases
b) Cost of capital is 10%
c) No salvage value

Calculate
1) Payback period
2) Accounting rate of Return
3) Net present value

1. Payback period

Year	X		Y	
0	$ 50, 000	-50, 000	$ 50, 000	-50, 000
1	15, 000	-35, 000	5, 000	-45, 000
2	20, 000	- 15, 000	15, 000	-30, 000
3	25, 000		20, 000	-10, 000
4	15, 000		30, 000	
5	10, 000		20, 000	

$$P = E + \frac{B}{C}$$

$$= 2 + \frac{15,000}{25,000} \qquad = 3 + \frac{10,000}{30,000}$$

$= 2.6$ $= 3.333$

Plant X is preferred than Y because the payback period is shorter.

Discounted Payback Period

A major shortcoming of payback periods is that it does not take into account the time value of money into account. To overcome this limitation the discounted payback period is suggested. Here, the cash flows are converted into their present values (applying suitable discounting factors) and then added to ascertain the period time required to recover the initial investment.

EX. **Year**	**Cash flow**	**Discount factor 10%**	**Present value**	
0	$ -10, 000		$ -10, 000	-10, 000
1	3, 000	0.909	2, 727	7, 273
2	3, 000	0.826	2, 478	4, 795
3	4, 000	0.751	3, 004	1, 791
4	4, 000	0.683	2, 732	941
5	5, 000	0.621	3, 105	
6	2, 000	0.565	1, 130	
7	3, 000	0.513	1, 539	

$$P = E + \frac{B}{C} = 3 + \frac{941}{3,105} = \underline{3.30}$$

2. $$ARR = \frac{Average\ income}{Average\ investment}$$

Here, you must differentiate between the annual income and annual cash flow. Annual income is after all the expenses like depreciation and tax. But, to arrive annual cash flows, you have to add back depreciation. In the above annual cash flows are given, to get annual income we have to deduct depreciation.

$$\text{Depreciation} = \frac{Investment}{Life\ of\ project}$$

$$= \frac{50,000}{5}$$

$$= \underline{10,000}$$

Plant X

$$= \frac{85,000/5 - 10,000}{50,000/2}$$

$$= \frac{17,000 - 10,000}{25,000}$$

$$= \frac{7,000}{25,000} \times 100$$

$= 28\%$

Plant Y

$$= \frac{90,000/5 - 10,000}{50,000/2}$$

$$= \frac{18,000 - 10,000}{25,000}$$

$$= \frac{8,000}{25,000} \times 100$$

$= 32\%$

3. Net Present Value

Year	**ACF**	**PV Factor**	**PV**	**Year**	**ACF**	**PV Factor**	**PV**
1	15, 000	0.909	13, 635	1	5, 000	0.909	4, 545
2	20, 000	0.826	16, 520	2	15, 000	0.826	12, 390
3	25, 000	0.751	18, 775	3	20, 000	0.751	15, 020
4	15, 000	0.683	10, 245	4	30, 000	0.683	20, 490
5	10, 000	0.620	6, 210	5	20, 000	0.620	12, 420
			65, 385				64, 865
	- Original Investment		50, 000				50, 000

15, 385 14, 865

X is preferred because of higher net present value.

5.8 ANSWERS TO CHECK YOUR PROGRESS

I. a) T
b) F
c) T
d) T
e) T
f) F
g) F
h) T

II. a
b
c
d

1.9 MODEL EXAMINATION QUESTIONS

1. The Great ways Company is considering replacing an old plant with a newer model having lower maintenance cost. The old plant has a current book value of $ 9, 000 and a (straight-line) depreciation charge $ 3, 000 per year for the remaining life of 3 years including current year. It will have no salvage value. However, at present the machine can be sold in the market for $ 6, 000. The existing machine requires an annual maintenance cost of $ 3, 000. The new machine will cost $ 12, 000 and require an annual maintenance cost of $ 12,000 and require an annual maintenance cost of $ 600. It's expected useful life is 3 years with no salvage value. Assume straight-line depreciation and tax 50% for new plot what is your replacement decision?

5. Farewell company has an investment opportunity costing $ 30, 000 with the following expected net cash flows (after taxes and before depreciation)

Year	Net cash flow
1	$ 4, 000
2	4, 000
3	4, 000
4	4, 000
5	4, 000
6	7, 000
7	9, 000
8	12, 000
9	9, 000
10	2, 000

Using 10% as the cost of capital determine the following

a) Payback period
b) Net present value at 10%
c) Accounting Rate of Return
d) Profitability Index at 10%
e) Internal rate of return with the help of 10% and 15% discounting factors