# Lecture 8 Answers

## Question One

**Payback Period**

Expansion Automation

0 (250,000) (200,000) 1 0 60,000 (250,000) (140,000) 2 0 50,000 (250,000) (90,000) 3 150,000 90,000 (100,000) 0 4 100,000 0

**Payback period is 4 years 3 years**

## Accounting rate of return

Expansion

Average return (£0+£0+£150,000+£100,000+£16,000+£116,000)/6 = £87,667

Average investment £250,000/2 = £125,000

Accounting rate of return £87,667 = 70% £ 125,000

Automation

Average return (£60,000+£50,000+£90,000+£90,000+£90,000+£90,000)/6 = £78,333

Average investment £200,000/2 = £100,000

Accounting rate of return £78,333 = 78% £ 100,000

## Net Present Value

EXPANSION AUTOMATION

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Cash flow | D.F. | NPV | Cash flow | D.F | NPV |
| 0 | (250,000) | 1 | (250,000) | (200,000) | 1 | (200,000) |
| 1 | 0 | 0.909 | 0 | 60,000 | 0.909 | 54,540 |
| 2 | 0 | 0.826 | 0 | 50,000 | 0.826 | 41,300 |
| 3 | 150,000 | 0.751 | 112,650 | 90,000 | 0.751 | 67,590 |
| 4 | 100,000 | 0.683 | 68,300 | 90,000 | 0.683 | 61,470 |
| 5 | 160,000, | 0.621 | 99,360 | 90,000 | 0.621 | 55,890 |
| 6 | 116,000 | 0.564 | 65,424 | 90,000 | 0.564 | 50,760 |
|  |  |  | 95,734 |  |  | 131,550 |

From the calculations Automation looks the better option quicker payback 3 years rather than 4, higher ARR and better NPV £131,550 rather than £95,734

But if go for automation forgo buying premises next door. The premises next door will not be available forever.

If having gone for expansion the business does well may want to expand and premises not available.

But if choose to go with premises and business is successful can automate at a later date.

Logistically good to have two plants next to each other can have centralised management and services.

## Question Two

### Investment 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Cash flow | D.F. 15% | NPV | Cash flow | D.F 30% | NPV |
| 0 | (1,500,000) | 1 | (1,500,000) | (1,500,000) | 1 | (1,500,000) |
| 1 | 430,000 | 0.870 | 374,100 | 430,000 | 0.769 | 330,670 |
| 2 | 430,000 | 0.756 | 325,080 | 430,000 | 0.592 | 254,560 |
| 3 | 430,000 | 0.658 | 282,940 | 430,000 | 0.455 | 195,650 |
| 4 | 430,000 | 0.572 | 245,960 | 430,000 | 0.350 | 150,500 |
| 5 | 430,000 | 0.497 | 213,710 | 430,000 | 0.269 | 115,670 |
| 6 | 430,000 | 0.432 | 185,760 | 430,000 | 0.207 | 89,010 |
| 7 | 430,000 | 0.376 | 161,680 | 430,000 | 0.159 | 68,370 |
|  |  |  | 289,230 |  |  | (295,570) |

Internal rate of return

Total difference in NPV 289,230 + 295,570 = 584,800

15% + (289,230/584.800 x (30%-15%)) = 22.4%

30% - (295,570/584,800 x (30%-15%)) = 22.4%

### Investment 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Cash flow | D.F. 15% | NPV | Cash flow | D.F 30% | NPV |
| 0 | (2,000,000) | 1 | (200,000 | (200,000) | 1 | (2,000,000) |
| 1 | 600,000 | 0.870 | 522,000 | 600,000 | 0.769 | 461,400 |
| 2 | 600,000 | 0.756 | 453,600 | 600,000 | 0.592 | 355,200 |
| 3 | 600,000 | 0.658 | 394,800, | 600,000 | 0.455 | 273,000 |
| 4 | 600,000 | 0.572 | 343,200 | 600,000 | 0.350 | 210,000 |
| 5 | 600,000 | 0.497 | 298,200 | 600,000 | 0.269 | 161,400 |
|  |  |  | 11,800 |  |  | (539,000) |

 Internal rate of return

Total difference in NPV 11,800+539,000 = 550,800

15% + (11,800/550,800 x (30%-15%) ) = 15.3%

30% - (539,000/550,800 x (30%-15%)) = 15.3%

Calculation of Discounted Cash Flow for Investment 3 (Discount Factor: 15%).

Calculation of Discounted Cash Flow for Investment 3 (Discount Factor: 30%).

Table: summary of findings for NPV and IRR.

## Question Three

### Project 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Cash flow | D.F. 15% | NPV | Cash flow | D.F 17% | NPV |
| 0 | (100,000) | 1 | (100,000) | (100,000) | 1 | (100,000) |
| 1 | 60,000 | 0.870 | 52,200 | 60,000 | 0.855 | 51,300 |
| 2 | 30,000 | 0.756 | 22,680 | 30,000 | 0.731 | 21,930 |
| 3 | *33,000+ 7,000*  40,000 | 0.658 | 26,320 | *33,000+ 7,000*  40,000 | 0.624 | 24,960 |
|  |  |  | 1,200 |  |  | (1,810) |

Internal rate of return

Total difference in NPV 1,200+1,810 = 3,010

15% + (1,200/3,010 x (17%-15%) ) = 15.8%

17% - (1,810/3,010 x (17%-15%)) = 15.8%

Calculation of cumulative cash flows.

Working: YR 2 10/40 = 0.25 year

0.25 x 12 months = 3 months

### Project 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Cash flow | D.F. 15% | NPV | Cash flow | D.F 17% | NPV |
| 0 | (60,000) | 1 | (60,000) | (60,000) | 1 | (60,000) |
| 1 | 36,000 | 0.870 | 31,320 | 36,000 | 0.855 | 30,780 |
| 2 | 16,000 | 0.756 | 12,096 | 16,000 | 0.731 | 11,696 |
| 3 | *22,000+ 6,000*  28,000 | 0.658 | 18,424 | *22,000+ 6,000*  28,000 | 0.624 | 17,472 |
|  |  |  | 1,840 |  |  | (52) |

Internal rate of return

Total difference in NPV 1,840+52 = 1,892

15% + (1,840/1,892 x (17%-15%) ) = 16.9%

17% - (52/1,892 x (17%-15%)) = 16.9%

Payback period

Year 0 Year 1 Year 2 Year 3

Cumulative cash flows (60) (24) (8) 20

Thus, the payback will occur after about 2 years 3 months (assuming that the cash flows accrue equally over the year), or 3 years if we assume year-end cash flows.

Working: Yr 2 8/28 = 0.28 yr x 12 = 3 month)

### Which project should be chosen?

Presuming that the firm is pursuing a wealth-maximisation objective, project 2 is preferable since it has the higher NPV.

The difference between the two NPVs is not significant

Payback - Project 1: 2 yrs 3 months; Project 2: 2 yrs 3 months

IRR Project 1: 15.8% (approx)

IRR Project 2: slightly below 17%

NPV is the preferred method of assessing investment opportunities because it fully addresses each of the following:

## The timing of the cash flows

Discounting the various cash flows associated with each project, according to when they are expected to arise, takes account of the fact that cash flows do not all occur simultaneously.

Associated with this is the fact that by discounting, using the opportunity cost of finance (namely the return that the next-best alternative opportunity would generate), the net benefit, after financing costs have been met, is identified (as the NPV).

## The whole of the relevant cash flows

NPV includes all of the relevant cash flows irrespective of when they are expected to occur.

It treats them differently according to their date of occurrence, but they are all taken into account in the calculation of NPV and they all have, or can have, an influence on the decision.

## The objectives of the business

NPV is the only method of appraisal where the output of the analysis has a direct bearing on the wealth of the business. (Positive NPVs enhance wealth; negative NPVs reduce it.)

Since most private-sector businesses seek to increase their value and wealth, NPV clearly is the best approach to use.

## Question Four

Table of calculation for payback.

Working payback: Project A Yr 3: 36/112 (Yr 4 cashflow) = 0.32 months

### Accounting Rate Of Return

Use formula ARR = Average profit/Average investment

### Project A

Average profit = (sum cash flows/7)

Sum of cashflows = £904

Average cashflows = £904/7 = £129.1429

Average investment project A = £350,000/2 = £175,000

ARR = (£129.14286/£175) x 100 = 73.8%

### Project B

Average profit = (sum cash flows/5)

Sum of cashflows = £770

Average cashflows = £770/5 = £154

Average investment project B= £350,000/2 = £175,000

ARR = (£154/£175) x 100 = 88%

### Project C

Average profit = (sum cash flows/4) Sum of cashflows = £630

Average cashflows = £630/4 = £157.5

Average investment project C= £350,000/2 = £175,000

ARR = (£157.5/£175) x 100 = 90%

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cash flow | D.F. | NPV |
| 0 | (350,000) | 1 | (350,000) |
| 1 | 100,000 | 0.909 | 90,900 |
| 2 | 110,000 | 0.826 | 90,860 |
| 3 | 104,000 | 0.751 | 78,104 |
| 4 | 112,000 | 0.683 | 76,496 |
| 5 | 138,000, | 0.621 | 85,698 |
| 6 | 160,000 | 0.564 | 90,240 |
| 7 | 180,000 | 0.513 | 92,340 |
|  |  |  | 604,638 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cash flow | D.F | NPV |
| 0 | (350,000) | 1 | (350,000) |
| 1 | 40,000 | 0.909 | 36,360 |
| 2 | 100,000 | 0.826 | 82,600 |
| 3 | 210,000 | 0.751 | 157,710 |
| 4 | 260,000 | 0.683 | 177,580 |
| 5 | 160,000 | 0.621 | 99,360 |
|  |  |  | 203,610 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cash flow | D.F | NPV |
| 0 | (350,000) | 1 | (350,000) |
| 1 | 200,000 | 0.909 | 181,800 |
| 2 | 150,000 | 0.826 | 123,900 |
| 3 | 240,000 | 0.751 | 180,240 |
| 4 | 40,000 | 0.683 | 27,320 |
|  |  |  | 163,260 |