- Acceptance of one project *precludes* the acceptance of competing projects
    - ✓ Technically impossible to undertake the proposed project if another project is accepted
    - ✓ The net cash flows from a project will completely **disappear** if another project is accepted
- The NPV and IRR may lead to ***different*** decisions if there is any difference in the magnitude or timing of the cash flows
    - ✓ In a conflict, **use the NPV** because it **always** gives a wealth-maximising decision

Discounted Cash Flow Methods
1. Net present value (NPV)
    - The difference between the *present value of the net cash flows* from an investment *discounted at the required rate of return* (i.e. opportunity cost of capital), and the initial cash outlay in the investment
        - Incremental after-tax cash flows must be used
        - The opportunity cost of capital is rate of return required on the next best (i.e. forgone) alternative investment and it reflects the project's risk
    - It represents the *immediate* increase (if a positive NPV) in the company's wealth (i.e. total market value of the company's shares) that will result from accepting the project – thereby increasing shareholders' wealth
    - **Acceptance rules**
        - Independent: Accept all positive NPV projects (NPV > 0)
        - Mutually exclusive: Accept the highest NPV project (so long as NPV > 0)
2. Internal rate of return (IRR)
    - The discount rate that equates the *present value of an investment's net cash flows* with its *initial cash outlay* (i.e. it is the discount rate at which NPV = 0)
    - It represents the highest rate of interest an investor could afford to pay, without losing money, if all the funds to finance the investment were borrowed, and the loan (principal and accrued interest) was repaid by using the cash proceeds from the investment as they were earned
    - It is the rate of return per annum that is expected to be earned by the project over its economic life
    - **Acceptance rules**
        - Independent: Accept project if *unique* IRR > required rate of return

- Mutually exclusive: Accept project B (<u>lower IRR</u>) in preference to project A (higher IRR) if project 'B minus A' *unique* incremental IRR > required rate of return (if possible, **use NPV instead**)

- Problems
    - **Multiple** internal rates of return
        - ✓ A necessary, but *not* sufficient, condition for multiple internal rates of return is that there is more than one sign *reversal* in the cash flows
        - ✓ The number of cash flow sign reversals corresponds to the *maximum*, but not necessarily the actual, <u>number of internal rates of return</u>
            - For example, three sign reversals mean there can be *at most three rates*
    - **Intermediate** internal rates of return
        - ✓ It is possible for a project to have *no* internal rate of return

Non-Discounted Cash Flow Methods

1. Accounting Rate of Return (ARR)
    - Average earnings from an investment, usually <u>after deducting both depreciation and income tax</u>, expressed as a percentage of either the initial investment or average investment
    - It represents the rate of return of a project with respect to <u>accounting criteria</u>
    - **Acceptance rules**
        - <u>Independent</u>: Accept project if ARR > specified minimum rate of return
        - <u>Mutually exclusive</u>: Accept the highest ARR project (so long as ARR > specified minimum rate of return)
    - Problems
        - Arbitrary (both the earnings and the hurdle requirement)
        - Ignores the time value of money
        - Favours projects with shorter lives

2. Payback period
    - The time it takes for the <u>accumulated net after-tax cash flows</u> generated by an investment to equal the initial outlay
    - It represents the time it takes for the project to recover its initial cash outlay
    - **Acceptance rules**
        - <u>Independent</u>: Accept project if payback period < specified maximum acceptable payback period
        - <u>Mutually exclusive</u>: Accept the shortest payback period project (so long as payback period < specified maximum acceptable payback period)
    - Problems
        - Arbitrary (hurdle requirement)

- Discriminates against long-term projects with cash flows later in their lives (it <u>ignores cash flows after the payback period cut-off date</u>)
- It is not a measure of a project's <u>profitability</u>
  - ✓ It fails to consider the magnitude and timing of <u>*all*</u> of a project's cash inflows and outflows
- Ignores the time value of money

Useful Formulae
■ Discounted cash flow methods
1. Net present value (NPV)

$$NPV = \frac{C_1}{(1+k)} + \frac{C_2}{(1+k)^2} + \cdots + \frac{C_N}{(1+k)^N} - I_0$$

$$NPV = \sum_{t=1}^{N} \frac{C_t}{(1+k)^t} - I_0$$

All subsequent cash outlays are included in the calculation of the new cash flows of future periods

2. Internal rate of return (IRR)
   - Solve for **r** in either of the following equations:

$$NPV \equiv 0 = \frac{C_1}{(1+\boldsymbol{r})} + \frac{C_2}{(1+\boldsymbol{r})^2} + \cdots + \frac{C_N}{(1+\boldsymbol{r})^N} - I_0$$

$$NPV \equiv 0 = \sum_{t=1}^{N} \frac{C_t}{(1+\boldsymbol{r})^t} - I_0$$

   - All subsequent cash outlays are included in the calculation of the new cash flows of future periods

3. Accounting Rate of Return (ARR)
   - Initial investment

$$ARR = \frac{average\ earnings}{initial\ investment} \times 100$$

   - Average investment

$$ARR = \frac{average\ earnings}{average\ investment} \times 100$$

   - Components of the ARR
     - Average earnings $= \frac{Total\ earnings}{N}$
     - Average investment $= \frac{initial\ investment + book\ value\ at\ end\ of\ period}{2}$

Week 9

- Examine the issues related to the estimation of incremental cash flows
- Understand the role of inflation in the capital budgeting process
- Analyse mutually exclusive projects with different lives
- Calculate the NPV of a project
- Understand the decision making rule for mutually exclusive projects
- Define the cost of capital and the weighted average cost of capital
- Estimate the weighted average cost of capital
- Analyse the limitation of the WACC

Estimation of Cash Flows

1. Assume all net cash flows are received at the end of period
2. Financing charges
   - The required rate of return should be used as the **discount rate**
     - It is the return that is sufficient to compensate shareholders and debtholders for the resources committed to the project (no profit)
     - This rate includes both interest paid to debtholders and returns to shareholders
   - Thus, financing charges should *not* be included in net cash flows
     - Otherwise, they will be *double counted*
3. Incremental cash flows
   - Include *all* **cash** flows that **change** if the project is undertaken
   - Sunk costs should be ignored – they are past outlays and irrelevant to future decision making
   - **Allocated costs**, such as rent, power and other overhead costs, should be only included if they would change if the project is undertaken
     - These costs tend to not vary with the project acceptance decision and are usually ignored
4. The residual value, which is the disposal or salvage value of a project's assets less any dismantling or removal costs, should be included in a project's net cash flows
5. Inflation
   - Refers to the increase in the general level of prices (and the resulting fall in the purchase power of money)
   - Two approaches to incorporating inflation into project evaluation
     - If estimating **nominal** cash flows, use **nominal** discount rate
       - ✓ The nominal cash flows are based on anticipated future price levels