

Learning Module 5: Capital Investments and Capital Allocation

Q.142 China Gold Corp is planning to open a project. The cost to build the new mine is \$1.3 million (paid at the end of the first year), and the mine should bring cash inflows of \$400,000 over the next six years (years 2 to 7). The cost to close down the mine over the following year (year 8) will be \$250,000.

The minimum price for this property, assuming that China Gold Corp wishes to sell it now, given a 15% required rate of return, is *closest to*:

- A. \$104,181.59
- B. \$119,808.82
- C. \$1,432,892.25

The correct answer is A.

To determine the minimum price for the property that China Gold Corp wishes to sell now, given a 15% required rate of return, we need to calculate the Net Present Value (NPV) of the cash flows associated with the project. The NPV is a method used in capital budgeting to analyze the profitability of an investment or project. It is calculated by summing the present values of incoming and outgoing cash flows over a period of time.

$$\begin{aligned} \text{Years 0} &= \$0 \\ \text{Year 1} &= -1,300,000 \times 1.15^{-1} \\ &= -1,130,434.78 \\ \text{Year 2} &= 400,000 \times 1.15^{-2} \\ &= 302,457.47 \\ \text{Year 3} &= 400,000 \times 1.15^{-3} \\ &= 263,006.49 \\ \text{Year 4} &= 400,000 \times 1.15^{-4} \\ &= 228,701.30 \\ \text{Year 5} &= 400,000 \times 1.15^{-5} \\ &= 198,870.69 \\ \text{Year 6} &= 400,000 \times 1.15^{-6} \\ &= 172,931.04 \\ \text{Year 7} &= 400,000 \times 1.15^{-7} \\ &= 150,374.82 \\ \text{Year 8} &= -250,000 \times 1.15^{-8} \\ &= -81,725.44 \\ \text{Total} &= \$104,181.59 \end{aligned}$$

We can obtain the above answer by using the "CF" function of the financial calculator as outlined below.

CF0 = 0,
 C01 = -1,300,000,
 F01 = 1,
 C02 = 400,000,
 F02 = 1,
 C03 = 400,000,
 F03 = 1,
 C04 = 400,000,
 F04 = 1,
 C05 = 400,000,
 F05 = 1,
 C06 = 400,000,
 F06 = 1,
 C07 = 400,000,
 F01 = 1,
 C08 = -250,000,
 F01 = 1

Then press "CPT" "NPV" and input I as 15, then press "CPT" to get the NPV as 104,181.59
 (Press ENTER after every value and use the arrows to navigate between values)
 A shorter way of doing this on the financial calculator is as shown below.

CF0 = 0
 C01 = -1,300,000
 C02 = 400,000
 F01 = 6,
 C02 = -250,000,
 F02 = 1

Then press "CPT" "NPV" and input "I" as 15, then press "CPT" to get the NPV as 104,181.59

Note: The above financial calculator shortcut is used when the yearly payments are similar. For instance, in this case, there were to be six cash flows of \$400,000 each. The "F01=6" takes care of the six payments.

B is incorrect. B is obtained by assuming that the first cash flow will be paid at year 0, i.e., (CF0=-1,300,000, C01=400,000, F01=6, C02=-250,000), which is incorrect as the question clearly states that the first cash flow will be paid at the end of the first year.

C is incorrect. C ignores the last cash flow and considers the cashflows only up to year 7.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.143 A project has the following cash flows:

Year 0: -\$180,000
Year 1: \$30,000
Year 2: \$30,000
Year 3: \$30,000
Year 4: \$140,000

The project's IRR is *closest to*:

- A. 8.04%
- B. 12.02%
- C. 24.76%

The correct answer is **A**.

The Internal Rate of Return (IRR) is a financial metric used to evaluate the profitability of potential investments. It is the discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. The IRR can be considered as the break-even interest rate from the investment perspective, beyond which an investment starts generating profit.

Using the financial calculator:

CF0 = -180,000, C01 = 30,000; F01 = 3; C02 = 140,000 >> IRR >> CPT = 8.04%

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.205 A project with an initial outlay of GBP 10,000 has the following annual cash flows over three years: GBP 6,000, GBP 5,000, and GBP 3,000. If the discount rate is 5%, the NPV of the project is *closest to*:

- A. GBP 2,841
- B. GBP 4,850
- C. GBP 12,841

The correct answer is **A**.

To calculate the Net Present Value (NPV) of a project, we discount all future cash flows back to

their present value and subtract the initial investment. The formula for NPV is given by:

$$NPV = -C_0 + \sum_{t=1}^n \frac{C_t}{(1+r)^t}$$

Where:

- C_0 is the initial investment,
- C_t is the cash flow at time t ,
- r is the discount rate, and
- n is the number of periods.

Given the initial outlay of GBP 10,000, annual cash flows of GBP 6,000, GBP 5,000, and GBP 3,000 over three years, and a discount rate of 5%, we can calculate the NPV as follows:

$$NPV = -10,000 + \frac{6,000}{(1+0.05)^1} + \frac{5,000}{(1+0.05)^2} + \frac{3,000}{(1+0.05)^3}$$

Calculating each term:

$$\frac{6,000}{1.05} = 5,714.29$$

$$\frac{5,000}{1.05^2} = 4,535.15$$

$$\frac{3,000}{1.05^3} = 2,591.47$$

Summing these values and subtracting the initial investment:

$$NPV = -10,000 + 5,714.29 + 4,535.15 + 2,591.47 = 2,840.91$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.206 A company plans to invest USD 4.5 million in a project. The project is expected to produce incremental net cash flows of USD 750,000 per year in perpetuity. If the company's opportunity cost of capital is 11%, then the net present value (NPV) of the project is *closest to*:

- A. USD 2,181,818.20.
- B. USD 2,318,181.80.
- C. USD 6,818,181.80.

The correct answer is **B**.

To calculate the Net Present Value (NPV) of a project, we use the formula:

$$NPV = \text{Initial Investment} + \frac{\text{Annual Cash Flow}}{\text{Discount Rate}}$$

Using the financial calculator:

$$CF=750,000; r=11\% = 0.11; CF0=-4,500,000$$

$$\begin{aligned} NPV &= CF_0 + \frac{CF}{r} \\ &= -4,500,000 + \frac{750,000}{0.11} \\ &= 2,318,181.80 \end{aligned}$$

Alternatively, we can use the financial calculator to arrive at the same answer

$$[CF_0 = -4.5, CF_1 = 0.75, F_01 = 1,000]$$

Then press "CPT" "NPV" and input I as 11. Then press "CPT" to get the NPV as 2.318181818 million (2,318,181.8)

Note: To determine the NPV of a cash flow in perpetuity, $F_01=1,000$.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.209 An investment's initial outlay is USD 1.7 million. The investment will give cash flows of USD 230,000 per year in perpetuity. The project's IRR is *closest to*:

- A. 7.4%.
- B. 13.5%.
- C. 35%.

The correct answer is **B**.

To determine the Internal Rate of Return (IRR) for an investment, we must understand the concept of IRR itself. The IRR is the discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero.

In simpler terms, it's the rate of return at which the investment breaks even considering the time value of money. For an investment with an initial outlay and perpetual cash flows, the formula to calculate IRR simplifies to:

$$\text{IRR} = \frac{\text{Annual Cash Flow}}{\text{Initial Investment}}$$

Given the initial investment (CF_0) is USD 1.7 million and the annual cash flow (CF) is USD 230,000, the IRR can be calculated as follows:

$$\text{IRR} = \frac{230,000}{1,700,000} = 0.135 \text{ or } 13.5\%$$

Understanding the IRR is crucial for investors as it helps in comparing the profitability of different investments, taking into account the time value of money. In this case, the IRR of 13.5% provides a realistic measure of the investment's potential return, considering the initial outlay and the expected perpetual cash flows.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.211 A company plans to invest \$7.7 million in a project, which will provide cash flows of \$1.5 million per year in each of the next six years. The company's opportunity cost of capital is 9%. The project's NPV is most likely?

- A. -\$971,122.10
- B. \$971,122.10
- C. \$7,004,587.16

The correct answer is **A**.

To calculate the Net Present Value (NPV) of the project, we need to consider both the initial investment and the present value of the expected cash flows. The NPV is calculated using the formula:

$$NPV = -\text{Initial Investment} + \sum_{t=1}^n \frac{\text{Cash Flow}_t}{(1+r)^t}$$

Where:

- Initial Investment is the upfront cost of the project, which is \$7.7 million in this case.
- Cash Flow_t is the cash inflow at time t, which is \$1.5 million per year for 6 years.
- r is the discount rate or the opportunity cost of capital, which is 9%.
- n is the number of periods, which is 6 years.

Given these values, the NPV can be calculated as follows:

$$NPV = -7,700,000 + \frac{1,500,000}{(1+0.09)^1} + \frac{1,500,000}{(1+0.09)^2} + \frac{1,500,000}{(1+0.09)^3} + \frac{1,500,000}{(1+0.09)^4} + \frac{1,500,000}{(1+0.09)^5} + \frac{1,500,000}{(1+0.09)^6}$$

After calculating the present value of each cash flow and summing them up, the NPV is found to be approximately -\$971,122.10. This indicates that the project is expected to result in a net loss when considering the time value of money at a 9% discount rate.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.213 XYZ Company paid USD 6.7 million in an investment project. It is expected to generate cash flows of USD 2.6 million per year in each of the next 3 years. The project's IRR is *closest to*:

- A. 6%
- B. 8%
- C. 12%

The correct answer is **B**.

To determine the Internal Rate of Return (IRR) for XYZ Company's investment project, we must find the discount rate that makes the net present value (NPV) of the cash flows equal to zero. The IRR is a critical measure in capital budgeting that helps in evaluating the profitability of a potential investment. The formula for NPV is given by:

$$NPV = -\text{Initial Investment} + \sum_{t=1}^n \frac{\text{Cash Flow}_t}{(1 + IRR)^t}$$

For XYZ Company, the initial investment is USD 6.7 million, and it expects to generate cash flows of USD 2.6 million per year for the next 3 years. Substituting these values into the NPV formula and setting NPV to zero gives us:

$$0 = -6,700,000 + \frac{2,600,000}{(1 + IRR)} + \frac{2,600,000}{(1 + IRR)^2} + \frac{2,600,000}{(1 + IRR)^3}$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.215 You are planning to invest \$3.5 million in a certain project. Incremental net cash flows are expected to be \$350,000 per year in perpetuity. The project's NPV, given a discount rate of 7%, is *most likely*?:

- A. \$1,500,000
- B. \$2,000,000
- C. \$5,000,000

The correct answer is **A**.

To calculate the Net Present Value (NPV) of an investment, we use the formula:

$$NPV = CF_0 + \frac{CF}{r}$$

where CF_0 is the initial cash flow (negative for investments), CF is the annual incremental net cash flow, and r is the discount rate. In this case, the initial investment (CF_0) is -\$3,500,000, the annual incremental net cash flow (CF) is \$350,000, and the discount rate (r) is 7% or 0.07.

Substituting these values into the formula gives:

$$NPV = -3,500,000 + \frac{350,000}{0.07} = 1,500,000$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.218 You invested USD 13.5 million, and you expect to get yearly cash flows of USD 1.8 million in perpetuity from the investment. The internal rate of return of the investment is *closest to*:

- A. 7.5%.
- B. 13.3%.
- C. 34%.

The correct answer is **B**.

To determine the internal rate of return (IRR) for an investment, we use the formula for the present value of a perpetuity. The IRR is the discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. In this case, the investment is USD 13.5 million, and the yearly cash flows are USD 1.8 million in perpetuity.

The formula for the present value of a perpetuity is given by:

$$PV = \frac{CF}{IRR}$$

Where PV is the present value of the investment, CF is the annual cash flow, and IRR is the internal rate of return. Rearranging the formula to solve for IRR gives:

$$IRR = \frac{CF}{PV}$$

Substituting the given values:

$$IRR = \frac{1,800,000}{13,500,000} = 0.133 \text{ or } 13.3\%$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.593 Which of the following is *least likely* a type of flexibility options?

- A. Growth option.
- B. Price-setting option.
- C. Production-flexibility options.

The correct answer is **A**.

A growth option is a type of sizing option that allows a company to make additional investments when future financial results are strong. It is also known as an expansion option.

B is incorrect. The price setting option is a type of flexibility option that allows management to increase prices that could benefit from the excess demand, which it cannot do by increasing production.

C is incorrect. Production-flexibility options are a type of flexibility option that allows companies the operational flexibility to alter production when demand varies from what is forecast.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (d): Describe types of real options relevant to capital investments.

Q.594 Which of the following is *least likely* a step in the capital allocation process?

- A. Investment analysis.
- B. Cash-flow based decisions.
- C. Monitoring and post-audit.

The correct answer is **B**.

Cash-flow-based decisions are not a distinct step in the capital allocation process. These steps include:

- identifying investment opportunities,
- investment analysis,
- decision-making, and
- monitoring and post-audit of investments.

A is incorrect. Investment analysis is indeed a core component of the capital allocation process. This step involves a detailed examination of potential investments, including the assessment of risks, expected returns, and alignment with strategic objectives.

C is incorrect. Monitoring and post-audit represent critical steps in the capital allocation process, focusing on the oversight and evaluation of investment performance after the allocation of resources. The monitoring and post-audit process is essential for ensuring that investments are delivering the anticipated benefits and for learning from the outcomes to improve future capital allocation decisions.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.595 Which of the following capital allocation steps *most likely* involves scheduling and prioritizing of capital investments and organizing proposals that best fit a company's strategy?

- A. Investment analysis
- B. Monitoring and post-audit
- C. Capital allocation planning

The correct answer is **C**.

Capital allocation planning is a crucial step in the capital allocation process, primarily focusing on scheduling, prioritizing capital investments, and organizing proposals that align closely with a company's strategic goals. This step is essential for ensuring that the company's financial resources are allocated in a manner that maximizes returns while adhering to the strategic objectives.

A is incorrect. Investment analysis, while a critical component of the capital allocation process, serves a different purpose. It is primarily concerned with evaluating the financial viability and potential returns of investment opportunities. This step involves detailed financial modeling, risk assessment, and forecasting to estimate the expected cash flows and profitability of potential investments.

B is incorrect. Monitoring and post-audit processes occur after the investment decisions have been made and implemented. This step is crucial for assessing the performance of investments against the expected outcomes and identifying any deviations from the planned results. It involves a systematic review of the actual outcomes of investments, comparing them with the forecasted results, and analyzing the reasons for any discrepancies. This process helps in understanding the effectiveness of the investment decisions and the accuracy of the initial analysis and forecasts.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.599 BestMilk Company is considering a project that calls for an initial cash outlay of \$40,000. If the expected net cash inflows from the project are \$6,139 for each of the nine years, then the IRR of the project is *closest to*:

- A. 7%.
- B. 8%.
- C. 9%.

The correct answer is **A**.

The Internal Rate of Return (IRR) is a financial metric used to evaluate the profitability of potential investments. It is the interest rate at which the net present value of all the cash flows (both positive and negative) from a project or investment equal zero.

The IRR for BestMilk Company's project can be calculated by setting the present value of the expected net cash inflows equal to the initial cash outlay and solving for the interest rate.

The equation for the present value of an annuity is given by:

$$PV = PMT \times \frac{1 - (1 + r)^{-n}}{r}$$

Where:

- PV is the present value (initial investment),
- PMT is the annual cash inflow,
- r is the interest rate (or IRR in this case), and
- n is the number of periods.

Given that the initial investment (PV) is \$40,000, the annual cash inflow (PMT) is \$6,139, and the number of periods (n) is 9 years, we can rearrange the formula to solve for r, the IRR. Using financial calculators or software, we find that the IRR that satisfies this equation is closest to 7%.

The IRR of approximately 7% means that the project's return is expected to average 7% annually, making it an attractive option if the company's required rate of return is below this threshold.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.601 A project has the following expected cash flows:

Year 0: -20,000
Year 1: 9,000
Year 2: 8,000
Year 3: 5,000
Year 4: 12,000

If the project's required rate of return is 12%, the NPV is *closest to*:

- A. -11,543
- B. 4,073
- C. 5,598

The correct answer is **C**.

To determine the Net Present Value (NPV) of a project, we discount its expected cash flows back to their present value using the project's required rate of return. The formula for calculating NPV is:

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1+r)^t}$$

Where:

- CF_t is the cash flow at time t .
- r is the required rate of return.
- n is the number of periods.

Given the project's cash flows and a required rate of return of 12%, we can calculate the NPV as follows:

$$NPV = -\frac{20,000}{(1+0.12)^0} + \frac{9,000}{(1+0.12)^1} + \frac{8,000}{(1+0.12)^2} + \frac{5,000}{(1+0.12)^3} + \frac{12,000}{(1+0.12)^4} = 5,598$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.607 Bike company purchased equipment that has a useful life of 7 years. The yearly net cash inflow is \$20,000. Its salvage value is zero, and the rate of return is 20%. The cost of the equipment is *most likely*? Please note: The asset is acquired at the NPV of the equipment.

- A. \$28,000
- B. \$72,100
- C. \$140,000

The correct answer is **B**.

The asset is acquired at the equipment's NPV. Therefore, the PV of the cash outflow is equal to the NPV of the equipment.

PV of outgo = PV of income

$$\text{PV of outgo} = \frac{20,000}{1.2} + \frac{20,000}{1.2^2} + \dots + \frac{20,000}{1.2^7}$$

Notice that the right-hand side (RHS) is a 7-year annuity with regular payments of 20,000.

Thus, we can use the formula for the PV of an annuity to get the solution to the RHS, instead of adding up the values manually:

$$\begin{aligned}\text{PV of outgo} &= 20,000 \times \frac{[1 - 1.2^{-7}]}{0.2} \\ &= 20,000 \times 3.605 \\ &= 72,100\end{aligned}$$

Alternatively, we could use the financial calculator to arrive at the above answer.

Key in "20,000" then "PMT" – 20,000 is the yearly payment made.

Then key in "20" then "1/Y."

Then key in "7" then "N."

Then click on "CPT" then "PV" to get the PV as 72,091.84 (72,100 when rounded off to the nearest hundreds)

A is incorrect. A has been incorrectly obtained by taking 20% of the cash inflows multiplied by the useful life of the equipment.

C is incorrect. C has been incorrectly obtained by directly multiplying the cash inflows (in place of discounting them at the required rate of return) by the useful life.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net

present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.1679 Which of the following projects is *most likely* an example of a regulatory, safety, and environmental project?

- A. Launching a new product line for remote villages of Spain.
- B. Replacing delivery trucks for more oil-efficient new vehicles.
- C. Installing trees along a plastic manufacturing facility to reduce pollution following the enactment of a new law.

The correct answer is C.

Capital investments/capital projects are investments with a life of one year or longer made by corporate issuers. These investments are made to generate value for their stakeholders by returning long-term benefits, and future cash flows greater than the funding costs.

Capital investments can be classified into four types of projects:

1. **Regulatory/compliance projects** - Undertaken due to a requirement by the government, regulatory agency, insurance company, or some other external party. These projects may generate no revenue for the
2. **Expansion projects** - Expansion projects increase the size of the activities of a business and, ultimately the size of the
3. **Going concern projects** - Occurs when companies replace old, worn-out, or broken equipment with newer, more efficient equipment so as to maintain existing size.
4. **Other projects** - Projects that fall under this category do not fall under either of the above Such projects are not subject to the usual capital budgeting analysis and are pet projects of someone in the company or are risky projects whose profitability is difficult to analyze using the usual methods.

Installing trees along a plastic manufacturing facility to reduce pollution following a new law is an example of a regulatory/compliance project. The project may not benefit the facility, but the facility must do so as required by a third party, in this case, the government, through the enactment of the new law.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.1681 Which of the following is *most likely* the name of the effect that affects other firms' cash flows with the acceptance of a project?

- A. Sunk costs.
- B. Externalities.
- C. Cannibalization.

The correct answer is **B**.

Externalities refer to the costs or benefits that affect a party who did not choose to incur that cost or benefit. These can be both positive, such as when a company's project improves the local infrastructure benefiting other businesses, or negative, such as when a project leads to increased pollution that affects nearby businesses.

A is incorrect. They remain the same regardless of the outcome of any future events. In the context of project evaluation, focusing on sunk costs can lead to suboptimal decision-making, as it may distract from evaluating a project's future potential and external impacts. Therefore, while sunk costs are an important financial concept, they do not directly affect other firms' cash flows with the acceptance of a project.

C is incorrect. Cannibalization refers to the reduction in sales volume, revenue, or market share of one product as a result of the introduction of a new product by the same company. While cannibalization is a specific type of negative externality, it primarily affects the company introducing the new product rather than other firms.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.1684 Mehmet Khali is a project analyst at Excel Investments. He is analyzing two independent projects - Project A and Project Z. Both projects have positive net cash flows but the cash flows of Project A is greater than the cash flows of Project Z. Which project should Khali accept?

- A. Project Z.
- B. Project A.
- C. Project A and Z.

The correct answer is **C**.

When analyzing independent projects, the decision to accept or reject a project is based on whether the project adds value to the firm, typically assessed through metrics like Net Present Value (NPV). In the case of Mehmet Khali analyzing Project A and Project Z, both projects have positive net cash flows, indicating that they are expected to add value to Excel Investments. Since these projects are independent, their evaluation and acceptance are not contingent upon each other. Therefore, Khali can accept both projects as they both contribute positively to the firm's value.

A is incorrect. Choosing Project Z alone overlooks the value that Project A can also bring to the firm. While Project Z may have positive net cash flows and thus be a viable project, the question does not suggest any constraints such as limited capital that would force Khali to choose between the two. In the absence of such constraints, rejecting a project with positive net cash flows (like Project A) without a compelling reason would not align with the goal of maximizing shareholder value.

B is incorrect. Project A has greater cash flows would not be a rational decision if both projects contribute positively to the firm's overall value.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.1686 Khalifa Fahami is a project analyst at New Dawn Ventures. She has been tasked to calculate the net present value (NPV) of a mini-mart project. The projected cash flows are given in the following table:

Year	Cash Flows
0	-550,000
1	40,000
2	70,000
3	110,000
4	230,000
5	310,000

If the required rate of return is 10%, the net present value (NPV) of the mini-mart project is closest to:

- A. -23,562
- B. 23,562
- C. 526,438

The correct answer is A.

To calculate the Net Present Value (NPV) of the mini-mart project, we need to discount the projected cash flows back to their present value at the required rate of return of 10% and then subtract the initial investment. The formula for NPV is given by:

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1+r)^t}$$

Where:

- CF_t is the cash flow at time t .
- r is the required rate of return.
- t is the time period.

Applying the given cash flows and the required rate of return, we calculate the NPV as follows:

$$NPV = -\frac{550,000}{(1+0.10)^0} + \frac{40,000}{(1+0.10)^1} + \frac{70,000}{(1+0.10)^2} + \frac{110,000}{(1+0.10)^3} + \frac{230,000}{(1+0.10)^4} + \frac{310,000}{(1+0.10)^5}$$

After performing the calculations, the NPV is found to be approximately -23,562.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.1687 Project Red and Project Blue are two mutually exclusive projects whose projected cash flows are given in the following table:

Year	Project Red	Project Blue
0	-800,000	-800,000
1	600,000	60,000
2	300,000	300,000
3	60,000	600,000

Using a required rate of return of 8% on both projects, the project(s) that will *most likely* increase value is/are:

- A. Project Red.
- B. Project Blue.
- C. Project Red and Project Blue.

The correct answer is **A**.

To determine which project between Project Red and Project Blue will most likely increase value, we calculate the Net Present Value (NPV) of each project using a required rate of return of 8%. A positive NPV indicates that the projected earnings generated by a project or investment exceeds the anticipated costs. Conversely, a negative NPV indicates that the project's costs outweigh its benefits. The NPV formula is given by:

$$NPV = \sum_{t=0}^n \frac{C_t}{(1+r)^t}$$

Where:

- C_t is the net cash inflow during the period t ,
- r is the discount rate, and
- n is the number of periods.

For Project Red, the NPV calculation using a discount rate of 8% is as follows:

$$NPV_{Red} = -\frac{800,000}{(1+0.08)^0} + \frac{600,000}{(1+0.08)^1} + \frac{300,000}{(1+0.08)^2} + \frac{60,000}{(1+0.08)^3} = 60,387$$

For Project Blue, the NPV calculation using a discount rate of 8% is as follows:

$$NPV_{Blue} = -\frac{800,000}{(1+0.08)^0} + \frac{60,000}{(1+0.08)^1} + \frac{300,000}{(1+0.08)^2} + \frac{600,000}{(1+0.08)^3} = -10,943$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.1689 Anna Smith is a project coordinator at Syrum Corps. She is analyzing two mutually exclusive projects: Project C and Project S. Both projects have positive net cash flows, but the net cash flows of Project S are greater than the cash flows of Project C. Smith should *most likely* accept which project?

- A. Project S.
- B. Project C.
- C. Both projects S and C

The correct answer is **A**.

When analyzing mutually exclusive projects, the decision criterion often involves comparing key financial metrics such as Net Present Value (NPV), Internal Rate of Return (IRR), or net cash flows. In the case of Anna Smith analyzing Project C and Project S, the fact that both projects have positive net cash flows is an initial indicator of their potential viability. However, since Project S has greater net cash flows than Project C, it suggests that Project S is likely to contribute more significantly to the firm's value over the project's lifespan.

This is a crucial consideration in capital budgeting decisions where the objective is to maximize shareholder wealth. Therefore, given that the projects are mutually exclusive, meaning only one of the projects can be chosen, Project S should be selected as it presents a higher potential for profitability and value addition to the company.

B is incorrect. In the context of mutually exclusive projects, the primary goal is to select the project that maximizes the firm's value, which is typically represented by the project with higher net cash flows, NPV, or other profitability metrics. Choosing a project with lower net cash flows over one with higher net cash flows would not align with the objective of maximizing shareholder wealth, making this option an incorrect choice.

C is incorrect. By definition, mutually exclusive projects mean that the acceptance of one project precludes the acceptance of the other. This is a critical distinction from independent projects, where each project's acceptance decision is made without regard to the other projects. In this scenario, since only one project can be chosen, the option to accept both projects is not viable, making this choice incorrect.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.1690 Identify the *most appropriate* term for the discount rate that makes the present value of expected incremental after-tax cash inflows equivalent to the initial cash outlay.

- A. Opportunity cost.
- B. Internal rate of return.
- C. Required rate of return.

The correct answer is **B**.

The most appropriate term for the discount rate that makes the present value of expected incremental after-tax cash inflows equivalent to the initial cash outlay is the Internal Rate of Return (IRR). The IRR is a critical financial metric used in capital budgeting to assess the profitability of potential investments. It is the rate at which the net present value (NPV) of all the cash flows (both positive and negative) from a project or investment equals zero. In simpler terms, the IRR is the break-even interest rate that equates the present value of an investment's expected gains with the initial cost of the investment.

A is incorrect. Opportunity cost refers to the benefit that is missed or given up when an investor, individual, or business chooses one alternative over another. While it is an important concept in economics and finance, particularly in the context of making investment decisions, it does not specifically relate to the discount rate that equates the present value of cash inflows to the initial investment.

C is incorrect. The Required Rate of Return (RRR) is the minimum return an investor expects to achieve by investing in a particular asset or project. It is determined by the investor's risk tolerance, the risk of the investment, and the returns available from other investments with similar risk profiles. The RRR is used as a benchmark to evaluate the attractiveness of an investment.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.1692 Mango Corp. is a project started by the retired CEO of a small American bank. Mango has the following projected cash flows:

Year	Cash flows
0	-550,000
1	40,000
2	70,000
3	110,000
4	230,000
5	310,000

Using a required rate of return of 5%, the internal rate of return (IRR) of Mango Corp. is *closest to*:

- A. 3.45%
- B. 4.78 %
- C. 8.74%

The correct answer is C.

To calculate the Internal Rate of Return (IRR) for Mango Corp., we must first understand what IRR represents. IRR is the discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. Given the cash flows from Mango Corp., we can use the formula for NPV and set it to zero to solve for IRR.

The cash flows for Mango Corp. are as follows:

- an initial investment of -\$550,000 (CF0),
- followed by inflows of \$40,000 (CF1), \$70,000 (CF2), \$110,000 (CF3), \$230,000 (CF4), and \$310,000 (CF5).

Using these cash flows and setting the NPV to zero, we can calculate the IRR. The calculation reveals that the IRR for Mango Corp. is approximately 8.74%. This rate is significant because it represents the project's expected rate of return based on its projected cash flows.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.1698 Inspiron is a private equity firm that is analyzing two mutually exclusive projects. Project Istanbul has an NPV of \$405 million, and Project Berlin has an NPV of \$450 million. Inspiron should *most likely* accept which project if the IRR of Project Istanbul is 32% and that of Project Berlin is 18%?

- A. Project Berlin will be accepted because it has a greater NPV.
- B. Project Istanbul will be accepted because it has a greater IRR.
- C. Both projects (Berlin and Instabul) since they both have a positive NPV.

The correct answer is **A**.

When evaluating mutually exclusive projects, the primary decision criterion should be the Net Present Value (NPV) rather than the Internal Rate of Return (IRR). This is because NPV directly measures the increase in value that a project is expected to generate for the firm, taking into account the time value of money and the firm's cost of capital.

In this scenario, Project Berlin has a higher NPV of \$450 million compared to Project Istanbul's NPV of \$405 million. This indicates that, from a value maximization perspective, Project Berlin is expected to add more value to Inspiron than Project Istanbul, making it the preferable choice.

The NPV criterion is generally considered superior to the IRR criterion for making investment decisions because it provides a direct estimate of the value addition to the firm, whereas the IRR is a relative measure that does not always account for the scale of the investment or the firm's financing mix.

B is incorrect. It measures the expected increase in the firm's value in absolute terms. Choosing a project solely based on IRR can be misleading, especially when the projects differ significantly in scale, timing of cash flows, or when the cost of capital varies over the project's life.

C is incorrect. It suggests accepting both projects since they both have positive NPVs. While it is true that independent projects with positive NPVs should generally be accepted, the key detail here is that the projects are mutually exclusive, meaning only one of the two can be chosen.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.1699 Texas & Sons is a circuit manufacturing firm. It is considering taking a new project that will generate an NPV of \$425 million. Calculate the new stock price of Texas & Sons if its current stock price is \$25 with 10 million shares outstanding.

- A. \$17.5
- B. \$42.5
- C. \$67.5

The correct answer is **C**.

To determine the new stock price of Texas & Sons after undertaking the new project, we must first calculate the total value of the company post-project. This involves adding the Net Present Value (NPV) of the project to the current market value of the company. The current market value is calculated by multiplying the current stock price by the number of shares outstanding. Therefore, the calculation is as follows:

$$\text{New Company Value} = (\text{Current Stock Price} \times \text{Number of Shares}) + \text{NPV}$$

Given that the current stock price is \$25 and there are 10 million shares outstanding, the current market value of Texas & Sons is \$250 million. The NPV of the new project is \$425 million. Thus, the new company value after the project is:

$$\text{New Company Value} = (25 \times 10,000,000) + 425,000,000 = 675,000,000$$

To find the new stock price, we divide the new company value by the number of shares outstanding:

$$\text{New Stock Price} = \frac{675,000,000}{10,000,000} = 67.5$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2577 An analyst at Franz Gas Inc. is analyzing the two projects that his firm undertook in the Southern region of France. The details regarding the Cash Flow and NPV of both projects are provided in the following table. Which of the following *most likely* explains why the NPV of Project X is greater than the NPV of Project X-2?

Year	Project X	Project X-2
0	-\$5,000,000.00	-\$5,000,000.00
1	\$1,300,000.00	\$800,000.00
2	\$1,300,000.00	\$1,000,000.00
3	\$1,300,000.00	\$1,200,000.00
4	\$1,300,000.00	\$1,500,000.00
5	\$1,300,000.00	\$2,100,000.00
Required Rate of Return	7.5%	7.0%
NPV	\$259,650.00	\$242,273.00
IRR	9.43%	8.53%

- A. Project X-2's total cash flow is greater than Project X's.
- B. Project X's required rate of return is greater than Project X-2's.
- C. Project X's timing of the cash flows is different than Project X-2's.

The correct answer is **C**.

The Net Present Value (NPV) represents the difference between the present value of cash inflows and the present value of cash outflows over a period. The NPV of Project X is greater than that of Project X-2 primarily due to the timing of the cash flows. In financial analysis, the timing of cash flows is a significant factor because cash flows received earlier are more valuable than those received later due to the time value of money. This principle states that a dollar today is worth more than a dollar in the future because of its potential earning capacity. Therefore, Project X, with its consistent early cash inflows, presents a more favorable NPV calculation when discounted back to the present value at the respective required rates of return.

A is incorrect. While it is true that Project X-2's total cash flow is greater than Project X's, this does not directly lead to a higher NPV. The total amount of cash flow is important, but the NPV calculation also heavily depends on the timing of these cash flows and the discount rate applied. In this case, despite Project X-2 having a higher total cash flow, the earlier and consistent cash inflows of Project X make it more valuable when discounted back to the present value, thus explaining the higher NPV for Project X.

B is incorrect. The assertion that Project X's required rate of return being greater than Project X-2's would lead to a higher NPV is fundamentally flawed. Generally, a higher discount rate (or required rate of return) decreases the present value of future cash flows, potentially lowering the NPV. However, the critical factor in this scenario is not the difference in required rates of return but the timing and consistency of cash inflows.

CFA Level I, Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2583 Assuming the initial cash outlay of a commercial real estate project is \$7 million, and the project generates identical cash flows of \$5 million for three years, then estimate the required rate of return if the NPV of the project is \$5.816 millions is *closest to*:

- A. 6.7%
- B. 8.3%
- C. 9.5%

The correct answer is **B**.

Since the project has identical cash inflows the required rate of return can be estimated using the TVM function of the financial calculator. As the NPV is equal to the PV of Cash inflows minus the PV of Cash outflows, then the PV of the project's cash inflows is:

$$\begin{aligned} \text{NPV} &= \text{PV of Cash inflow} - \text{PV of Cash outflow} \\ &\Rightarrow 5.816 = \text{PV of Cash inflow} - 7 \\ \therefore \text{PV of Cash inflow} &= 5.816 + 7 = 12.816 \end{aligned}$$

Using this value, we can use this value to calculate the required rate of return.

Using a financial calculator, we can calculate the required rate of return.

(N=3, PV=-12.816, PMT=5, FV=0, CPT=I).

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2585 An analyst is analyzing an equipment replacement project for a private company it undertook a few years ago. The project's required initial investment was \$12,000,000 and generated cash flows of \$2,500,000 each year for six years. Due to the flexible regulations regarding the disclosure of financial data of private companies, an analyst is unable to gather complete data. Using the available data, the IRR of the project is *most likely*:

- A. 1.38%
- B. 6.77%.
- C. 13.82%

The correct answer is **B**.

The IRR is the rate that equals the PV of cash flows to the project's initial cash outflow. Since the discount rate required to calculate the PV of the cash flows is not given, the IRR will be estimated using the TVM function of the financial calculator.

The IRR can be calculated as:

N=6; PV=-12,000,000; PMT=2,500,000; FV=0; CPT => I = 6.77%

Alternatively, a candidate can choose to use the CF function of the calculator, as shown below.

CF0=-12,000,000; CF1=2,500,000, F1=6; then "IRR" then "CPT" to get the IRR as 6.77

(note that in place of using the F1=6 function, a candidate could choose to input all the CFs as CF1=2,500,000; CF2=2,500,000; CF3=2,500,000; CF4=2,500,000; CF5=2,500,000; CF6=2,500,000; then proceed as above)

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2586 Ankara Ceramics Company is interested in a project that will require two cash outlays of \$25 million each, at the initiation (year 0) and in the 4th year of the project (year 4). Assuming that the project is expected to generate annual cash flows of \$8.5 million for 6 years (year 1 to year 6), then calculate the NPV of the project using a discount rate of 9%.

- A. -\$4.58 million.
- B. \$13.13 million.
- C. \$38.13 million.

The correct answer is **A**.

NPV of Ankara Ceramic's project can be estimated using the financial calculator. Since the project requires two cash outlays of \$25 million, at initiation and in the 4th year of the project, the net cash outflow of the project in the 4th year will be \$16.5 million (4th year outflow (-\$25) + 4th year cash inflow (\$8.5)).

The NPV of the project using the required rate of return of 9% is calculated as -\$4.58 million using the following table.

	(in million \$)
CF = 0	-\$25.00
CF = 1	\$8.50
CF = 2	\$8.50
CF = 3	\$8.50
CF = 4	-\$16.50
CF = 5	\$8.50
CF = 6	\$8.50
Required Rate	9%
NPV	-\$4.58

We can use the "CF" function of the financial calculator to arrive at the above answer, as shown below.

CF0=-25,000,000, C01=8,500,000, C02=8,500,000, C03=8,500,000, C04 = (8,500,000-25,000,000 = -16,500,000) C05=8,500,000, C06=8,500,000 then press "CPT" "NPV" and input "I" as 9, then press "CPT" to get the NPV as -4,580,322.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2588 Muhammad is a project manager at D.A. Corp. He has been asked to choose some of the many proposed projects that maximize the shareholders' value. Assuming the budget is \$1,000,000, which of the following projects provided in the table below should he undertake?

	East Project	West Project	South Project	Central Project
Investment	\$500,000	\$300,000	\$250,000	\$1,000,000
Cash Flows	\$230,000	\$170,000	\$200,000	\$310,000
No. of Years	5	6	5	7
Required Rate of Return	8%	5%	9%	10%

- A. Central Project.
- B. East Project and West Project.
- C. West Project and South Project.

The correct answer is **C**.

Muhammad will only choose Project West and South as it only costs \$550,000 to undertake both projects, and they maximize the NPV. The following solution demonstrates capital rationing.

	East Project	West Project	South Project	Central Project
Investment	\$500,000	\$300,000	\$250,000	\$1,000,000
Cash Flows	\$230,000	\$170,000	\$200,000	\$310,000
No. of Years	5	6	5	7
Required Rate of Return	8%	5%	9%	10%
NPV	\$418,323	\$562,867	\$527,930	\$509,210

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2589 Harish Kumar, Chief Investment Officer at Hind Investment Fund, analyzes two mutually exclusive projects to undertake. Assuming that Project A has an IRR of 19% and an NPV of \$1,117,878, and Project B has an IRR of 27.3% and an NPV of \$1,009,870, determine which of the following is the *most appropriate* decision for Kumar.

- A. Kumar should invest in Project B because it has a higher IRR.
- B. Kumar should invest in Project A because it has a higher NPV.
- C. Kumar should invest in both Project A and Project B because they both have positive NPVs.

The correct answer is **B**.

When evaluating mutually exclusive projects, the decision criterion should prioritize the project that adds the most value to the firm. In this context, Net Present Value (NPV) is the superior metric because it directly measures the dollar increase in shareholder wealth.

Project A, with an NPV of \$1,117,878, promises to add more value to the firm than Project B, which has an NPV of \$1,009,870. The Internal Rate of Return (IRR) is a useful metric for assessing the efficiency of an investment, but it does not always align with value maximization, especially in cases of mutually exclusive projects.

Therefore, despite Project B having a higher IRR of 27.3% compared to Project A's IRR of 19%, Project A is the more appropriate choice because of its higher NPV.

A is incorrect. It directly measures the increase in shareholder wealth. Therefore, despite Project B's higher IRR, it is not the optimal choice due to its lower NPV compared to Project A.

C is incorrect. While both projects have positive NPVs, indicating that they would add value to the firm if undertaken independently, the mutual exclusivity requires a choice between them. Thus, despite both projects being potentially profitable, the mutual exclusivity necessitates a choice, with preference given to the project with the higher NPV, which is Project A in this case.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2661 The rate at which a 9-year project with an initial investment of \$540,000 and incremental cash inflows of \$74,000 per year will result in a positive Net Present Value (NPV) is closest to:

- A. 3.74%
- B. 4.41%
- C. 7.10%.

The correct answer is A.

To determine the rate that will result in a positive NPV among the three rates given, we will have to determine the project's IRR. We can do this using the cash flow function of the financial calculator:

$CF_0 = -540,000; CF_1 = 74,000; F01 = 9; CPT \rightarrow IRR$

That gives an IRR value of 4.41%. What does that imply?

Any rate below 4.41% will result in a positive NPV, while a rate above 4.41% will result in a negative NPV.

From our choices, we only have one value that's less than 4.41%, i.e., 3.74%

We can solve the NPV at 3.74% with the cash flow function of the financial calculator as:

$CF_0 = -540,000; CF_1 = 74,000; F01 = 9; I = 3.74; CPT \rightarrow NPV$

$NPV = \$16,792$

You can also use the other two rates in place of 3.74% to test the validity of the IRR argument.

B is incorrect. At 4.41%, the NPV will be zero. IRR is the discount rate that makes a project's NPV zero, and 4.41% is the project's IRR.

C is incorrect. 7.10% is greater than the project's IRR. A rate greater than the project's IRR will result in a negative NPV.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2662 Which of the following *most likely* defines the Internal Rate of Return (IRR)?

- A. An opportunity cost is used to find the present value of cash flows.
- B. The discount rate that makes the Net Present Value (NPV) of a project equal to zero.
- C. A rate that is used to equate the investment costs of the project to the investment benefits of the project.

The correct answer is **B**.

The Internal Rate of Return (IRR) is a financial metric used to evaluate the profitability of potential investments. It is defined as the discount rate that makes the Net Present Value (NPV) of all cash flows from a particular project equal to zero. The IRR is a critical component in capital budgeting to assess the desirability of an investment or project. By calculating the IRR, investors and managers can identify the rate of return at which the present value of the project's cash inflows equals the present value of its outflows, thereby determining the project's break-even point in financial terms.

A is incorrect. This option describes the concept of opportunity cost rather than the IRR. Opportunity cost refers to the cost of choosing one investment over another. While it is a crucial concept in finance and economics, it does not specifically relate to the calculation or definition of the IRR. The IRR is focused on finding the specific discount rate that brings the NPV of a project to zero, not on comparing the present value of cash flows against other potential investments.

C is incorrect. The IRR provides a precise threshold for decision-making, helping investors and managers to determine whether a project's return exceeds its cost of capital. The description provided in option C is too broad and lacks the specificity required to accurately define the IRR.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2663 Red Construction Co. is planning to invest CAD 91,500,000 in an infrastructure project in Montreal. The project is expected to generate CAD 3,200,000 in perpetuity. Assuming a discount rate of 3.4%, the Internal Rate of Return (IRR) of the project is *closest to*:

- A. 3.2%.
- B. 3.49%.
- C. 3.61%.

The correct answer is **B**.

The Internal Rate of Return (IRR) is a financial metric used to evaluate the profitability of potential investments. It is the discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero.

In the case of Red Construction Co.'s investment in an infrastructure project in Montreal, the IRR can be calculated using the formula for the IRR of a perpetuity, which is:

$$\frac{\text{Annual Cash Flow}}{\text{Initial Investment}}$$

Given that the project is expected to generate CAD 3,200,000 in perpetuity from an initial investment of CAD 91,500,000, the IRR is calculated as follows:

$$\text{IRR} = \frac{3,200,000}{91,500,000} = 0.0349 \text{ or } 3.49\%$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2664 As an analyst, you're evaluating two projects, Mi6 and Ci7, using the data provided in the following table. Assuming that both projects are independent and that the discount rate is 8.09%, which of the following projects is/are *most likely* to be selected according to the NPV rule?

	Project Mi6	Project Ci7
Year 0	-\$40,300,000	-\$109,400,000
Year 1	\$9,700,000	\$18,000,000
Year 2	\$9,700,000	\$11,500,000
Year 3	\$9,700,000	\$17,700,000
Year 4	\$9,700,000	\$21,300,000
Year 5	\$9,700,000	\$27,000,000
Year 6	\$9,700,000	\$35,000,000
Year 7	-	\$38,500,000

- A. Project Ci7.
- B. Project Mi6.
- C. Project Mi6 & Project Ci7.

The correct answer is **C**.

As calculated in the following table, both Project Mi6 and Ci7 have positive NPVs. Since both independent projects generate positive NPVs, both projects can be accepted as per the NPV Rule.

	Project Mi6	Project Ci7
CF 0	-\$40,300,000	-\$109,400,000
CF 1	\$9,700,000	\$18,000,000
CF 2	\$9,700,000	\$11,500,000
CF 3	\$9,700,000	\$17,700,000
CF 4	\$9,700,000	\$21,300,000
CF 5	\$9,700,000	\$27,000,000
CF 6	\$9,700,000	\$35,000,000
CF 7	-	\$38,500,000
Discount Rate	8.09%	8.09%
NPV	\$4,419,763.92	\$9,294,716.90

Note: To calculate this using the financial calculator for Project Ci7:

Go to the cash flow register by pressing (CF). Next clear prior data in that function by pressing (2nd) (FV) (2nd) (CE/C).

Press (CF) then -109,400,000 (make sure the sign is negative) "Enter" (down arrow)
 18,000,000 "Enter" (down arrow) (down arrow)
 11,500,000 "Enter" (down arrow) (down arrow)

...

38,500,000 "Enter"

Press "NPV" to display I = 0.0000. Enter the required rate of return in decimal format 'as-if there is a percentage sign following: 8.09

Press "Enter". Press the down arrow key, then press "CPT" to display the dollar amount of the

NPV.

To calculate the NPV using the financial calculator for project Mi6:

Proceed as above but to shorten the procedure under cashflows enter: CFO=-40,300,000; CF1=9,700,000, F1=6 (number of times the cash flow 9,700,000 is repeated) then press NPV, input I as 8.09% and press "CPT" to get the NPV as \$4,419,763.92.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2665 As an analyst, you're evaluating two projects, Mi6 and Ci7. The data relating to both projects is given in the following table:

	Project Mi6	Project Ci7
Year 0	-\$40,300,000	-\$109,400,000
Year 1	\$9,700,000	\$18,000,000
Year 2	\$9,700,000	\$11,500,000
Year 3	\$9,700,000	\$17,700,000
Year 4	\$9,700,000	\$21,300,000
Year 5	\$9,700,000	\$27,000,000
Year 6	\$9,700,000	\$35,000,000
Year 7	-	\$38,500,000

Assuming that both projects are independent and that the discount rate is 8.09%, which of the following projects is/are *most likely* to be selected according to the IRR rule?

- A. Project Ci7.
- B. Project Mi6.
- C. Project Mi6 & Project Ci7.

The correct answer is **C**.

As calculated in the following table, the IRRs of Project Mi6 and Ci7 is greater than the discount rate (or opportunity cost). Since the IRRs of both independent projects are greater than the discount rate, both projects can be accepted as per the IRR rule.

The easiest way to do the calculations is by using the financial calculator with the following inputs and then compute the IRR:

	Project Mi6	Project Ci7
CF 0	-\$40,300,000	-\$109,400,000
CF 1	\$9,700,000	\$18,000,000
CF 2	\$9,700,000	\$11,500,000
CF 3	\$9,700,000	\$17,700,000
CF 4	\$9,700,000	\$21,300,000
CF 5	\$9,700,000	\$27,000,000
CF 6	\$9,700,000	\$35,000,000
CF 7	-	\$38,500,000
Discount Rate	8.09%	8.09%
NPV	\$4,419,763.92	\$9,294,716.90
CPT -> IRR	11.63%	10.13%

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2666 As an analyst you're evaluating two projects, Mi6 and Ci7, using the data provided in the following table. Assuming for this question only that both projects are mutually exclusive and that the discount rate is 8.09%, which of the following projects is/are *most likely* to be selected considering both the IRR and the NPV rule?

	Project Mi6	Project Ci7
Year 0	-\$40,300,000	-\$109,400,000
Year 1	\$9,700,000	\$18,000,000
Year 2	\$9,700,000	\$11,500,000
Year 3	\$9,700,000	\$17,700,000
Year 4	\$9,700,000	\$21,300,000
Year 5	\$9,700,000	\$27,000,000
Year 6	\$9,700,000	\$35,000,000
Year 7	-	\$38,500,000

- A. Project Ci7.
- B. Project Mi6.
- C. Project Mi6 & Project Ci7.

The correct answer is **A**.

As calculated in the following table, Project Mi6 generates an NPV of \$4,419,763.92 and an IRR of 11.63%. Project Ci7 generates an NPV of \$9,294,716.9 and an IRR Of 10.13%. Since it is

assumed that both the projects are mutually exclusive, the project that generates the greater NPV will be accepted. In this case, it is Project Ci7.

	Project Mi6	Project Ci7
CF 0	-\$40,300,000	-\$109,400,000
CF 1	\$9,700,000	\$18,000,000
CF 2	\$9,700,000	\$11,500,000
CF 3	\$9,700,000	\$17,700,000
CF 4	\$9,700,000	\$21,300,000
CF 5	\$9,700,000	\$27,000,000
CF 6	\$9,700,000	\$35,000,000
CF 7	-	\$38,500,000
Discount Rate	8.09%	8.09%
NPV	\$4,419,763.92	\$9,294,716.90
CPT -> IRR	11.63%	10.13%

B and C are incorrect. Since the projects are mutually exclusive, only Ci7, which has a greater NPV, will be selected. Whenever the NPV and IRR methods are conflicting, we choose the NPV method over the IRR method. A project can have multiple IRRs but only one NPV, making the NPV method the most suitable method to rank projects.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2667 Which of the following statements is *most likely* accurate?

- A. If two projects are mutually exclusive, the project with the highest IRR will be accepted according to the IRR rule.
- B. If two project are independent, only the project(s) with IRR greater than the opportunity cost will be accepted as per the IRR rule.
- C. If two mutually exclusive projects generate negative NPVs, the project with the smaller negative NPV will be selected as per the NPV rule.

The correct answer is **B**.

When evaluating independent projects, the Internal Rate of Return (IRR) rule is a critical tool for decision-making. Independent projects are those whose cash flows do not affect or are not affected by the cash flows of other projects. This means that the acceptance of one project does not preclude the acceptance of another.

According to the IRR rule, a project should be accepted if its IRR exceeds the opportunity cost of capital, which represents the return that could be earned on an investment with a similar risk profile. Therefore, for independent projects, each project is evaluated on its own merits, and all projects with an IRR greater than the opportunity cost of capital should be accepted. This approach ensures that the investments made are expected to yield returns higher than what could be earned elsewhere, given the risk.

A is incorrect. Neither project is expected to generate a return higher than what could be achieved with an alternative investment of similar risk.

C is incorrect. The Net Present Value (NPV) rule states that an investment should be made if the NPV is positive, as it indicates that the project is expected to add value to the firm. When comparing mutually exclusive projects, the one with the higher (or less negative) NPV would indeed be preferable if both projects have negative NPVs.

The statement in option C misrepresents the NPV rule by suggesting that a project with a smaller negative NPV should be selected, which contradicts the fundamental principle that only projects with positive NPVs should be accepted to increase firm value.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.2668 As an analyst, you're analyzing two mutually exclusive projects for A.V.M. Company as shown in the following table. Assuming a discount rate of 14.5%, which of the following options will *most likely* be accepted?

	Project Mi6	Project Ci7
Year 0	-\$20,000,000	-\$100,000,000
Year 1	\$7,000,000	\$22,000,000
Year 2	\$7,000,000	\$22,000,000
Year 3	-\$10,000,000	\$22,000,000
Year 4	\$12,600,000	\$22,000,000
Year 5	\$12,600,000	\$22,000,000

- A. The 'Mi6' project will be selected because it has a higher IRR.
- B. The 'Mi6' project will be selected because it has a higher NPV.
- C. None of the projects will be selected as both projects have negative NPVs.

The correct answer is **C**.

In mutually exclusive projects, the investor can only invest in one project at the cost of another. For mutually exclusive projects with positive NPVs, the project with the highest NPV will be accepted. In the given question, both the 'Mi6' and the 'Ci7' projects have negative NPVs, and IRRs smaller than the discount rate. Therefore, both projects will be rejected.

	Project Mi6	Project Ci7
CF 0	-\$20,000,000	-\$100,000,000
CF 1	\$7,000,000	\$22,000,000
CF 2	\$7,000,000	\$22,000,000
CF 3	-\$10,000,000	\$22,000,000
CF 4	\$12,600,000	\$22,000,000
CF 5	\$12,600,000	\$22,000,000
Discount Rate	14.50%	14.50%
NPV	-\$1,475,647.90	-\$25,371,045.34
IRR	11.77%	3.26%

Note: The NPV and IRR of the two projects can be determined using the CF function of the financial calculator.

For project Mi6: (CF0=-20,000,000, C01=7,000,000, C02=7,000,000, C03=-10,000,000, C04=12,600,000, C05=12,600,000) After inputting all cashflows, press "CPT" "NPV" and input "I" as 14.5 then press "CPT" to get the NPV as -1,475,647.90.

For IRR, press "CPT" "IRR" then press "CPT" to get the IRR as 11.77%

For project Ci7: (CF0=-100,000,000, C01=22,000,000, C02=22,000,000, C03=22,000,000, C04=22,000,000, C05=22,000,000) (To shorten this process, after inputting CF0 as -100,000,000, we can input C01 as 22,000,000 then F01 as 5). F01=5 takes acre of the fact that there are five cashflows of \$22,000,000 each. After inputting all cash flows, press "CPT" "NPV" and input "I" as 14.5 then press "CPT" to get the NPV as -25,371,045.34.projects.

For IRR, press "CPT" "IRR" then "CPT" to get the IRR as 3.26%

A and B are incorrect. None of the projects are profit-maximizing as they both have a negative NPV and an IRR lower than the required rate of return of both.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.2669 A 3-year construction project generates semi-annual cash inflows of \$79,200. Assuming that the project has a net present value (NPV) of \$18,578 at the cost of capital of 7.5%, then the initial cash outlay of the project is *closest to*:

- A. \$205,962
- B. \$400,000
- C. \$418,577.67

The correct answer is **B**.

To determine the initial cash outlay of the project, we must understand the relationship between the net present value (NPV), the present value (PV) of future cash inflows, and the initial investment. The NPV is calculated as the difference between the PV of cash inflows and the initial investment.

Given that the NPV is \$18,578 and the cash inflows are semi-annual over a 3-year period, we can use the formula for NPV to find the initial investment. The cost of capital, or discount rate, is 7.5%, which must be adjusted for semi-annual compounding by dividing it by 2. The formula for NPV is as follows:

$$NPV = PV \text{ of cash inflows} - \text{Initial investment}$$

Given the NPV and the PV of cash inflows, we can rearrange the formula to solve for the initial investment:

$$\text{Initial investment} = PV \text{ of cash inflows} - NPV$$

Using a financial calculator or an equivalent financial function in software, with N=6 (for 3 years semi-annually), I=7.5/2 (to adjust for semi-annual compounding), PMT=79,200 (semi-annual cash inflow), and FV=0 (since we are not considering any terminal value), we find that the PV of cash inflows equals \$418,578. Subtracting the NPV of \$18,578 from this amount gives us the initial cash outlay:

$$\text{Initial cash outlay} = \$418,578 - \$18,578 = \$400,000$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3411 A project requires an initial investment of \$5 million and a second investment of \$2 million at the end of the 3rd year. The expected cash flows from the project for the next 5 years

are given in the following exhibit.

Exhibit: 5-year Project - Cash Inflows

End of the 1st Year	\$0.5 million
End of the 3rd Year	\$8 million
End of the 4th Year	\$4 million
End of the 5th Year	\$1 million

If the discount rate for the project is 10%, then the net present value (NPV) of the project is *closest* to:

- A. \$3.31 million.
- B. \$4.82 million.
- C. \$8.31 million.

The correct answer is **A**.

The cash flows from the entire project are given in the following table:

Year	Outflow	Inflow	Net Flows
Beginning of 1st Year	5 million	0	-5 million
End of 1st Year	0	0.5 million	+0.5 million
End of 2nd Year	0	0	0
End of 3rd Year	2 million	8 million	+6 million
End of 4th Year	0	4 million	+4 million
End of 5th Year	0	1 million	+1 million

(All \$ values in million)

$$NPV(\text{project}) = PV_0 + PV_1 + PV_2 + PV_3 + PV_4 + PV_5$$

$$PV_0 = -5 \text{ million}$$

$$PV_1 = \frac{+0.5}{(1 + 10\%)^1} = 0.45$$

$$PV_2 = 0$$

$$PV_3 = \frac{6}{(1 + 10\%)^3} = 4.51$$

$$PV_4 = \frac{4}{(1 + 10\%)^4} = 2.73$$

$$PV_5 = \frac{1}{(1 + 10\%)^5} = 0.62$$

$$NPV = -5 + 0.45 + 4.51 + 2.73 + 0.62 = 3.31$$

We can use the "CF" function of the financial calculator to arrive at the above answer, as shown

below.

(CF₀= - 5,000,000, C₀₁= 500,000, C₀₂ = 0, C₀₃ = (8,000,000 - 2,000,000 = 6,000,000), C₀₄ = 4,000,000, C₀₅ = 1,000,000)

After inputting all cash flows, press “CPT” “NPV,” then input “I” as 10, then press “CPT” to get the “NPV” as 3.31 million.

B is incorrect. The \$2 million cash outflow in year three has been ignored.

C is incorrect. C represents the present value of the project’s cash flows (including the cash outflow in year 3), not the project’s NPV. The NPV is obtained by subtracting a project’s initial cash outlay from the present value of its cash inflows.

CFA Level I, Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3412 Consider the following statements:

- I. If the internal rate of return (IRR) is higher than the discount rate of the project, the net present value (NPV) is positive.
- II. A project can have multiple internal rates of return.

Which of these statements is/are accurate?

- A. I & II
- B. I only
- C. II only

The correct answer is **A**.

The IRR is defined as the discount rate that makes the NPV of all cash flows from a particular project equal to zero. Therefore, if the IRR is higher than the project's discount rate, it implies that the project would generate a positive NPV, indicating that the project is expected to yield a return higher than the cost of capital. This makes the investment worthwhile from a financial perspective.

When the IRR exceeds the discount rate, it means the project's returns surpass the hurdle rate (the minimum required rate of return), leading to a positive NPV. This is a fundamental principle in capital budgeting that helps in evaluating the viability of projects. A positive NPV signifies that the project is expected to add value to the firm, making it an attractive investment option.

Projects with non-conventional cash flows, characterized by multiple changes in cash flow direction (from inflows to outflows or vice versa), can indeed have multiple IRRs. When there are multiple sign changes in cash flows, the IRR equation can yield more than one solution. This complexity is one reason why some financial analysts prefer the NPV method for project evaluation, as it provides a single, unambiguous measure of a project's value.

B is incorrect. It suggests that only statement I is accurate. However, as explained, both statements I and II accurately describe important concepts in financial management related to project evaluation and the calculation of IRR and NPV.

C is incorrect. It suggests that only statement II is accurate.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3413 Consider the following statements:

1. The net present value (NPV) assumes that a project's reinvestment rate is equal to its discount rate.
2. The internal rate of return (IRR) assumes that the project's reinvestment rate is equal to its internal rate of return.

Which of these statements is/are accurate?

- A. I & II.
- B. I only.
- C. II only.

The correct answer is **A**.

Statement I is accurate. The NPV method is a tool used to evaluate the profitability of an investment or project. It calculates the difference between the present value of cash inflows and the present value of cash outflows over a period of time. The NPV formula is expressed as:

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

where C_t is the cash flow at time t , r is the discount rate, and N is the number of periods. The discount rate in the NPV formula represents the project's cost of capital or the minimum required rate of return.

By discounting future cash flows back to their present value using the discount rate, the NPV method implicitly assumes that all cash inflows are reinvested at the discount rate. This assumption is critical because it affects the project's perceived profitability and the decision to invest.

Statement II is accurate. The IRR is the discount rate that makes the NPV of all cash flows from a particular project equal to zero. It is a commonly used metric to evaluate the attractiveness of an investment or project. The formula for calculating IRR does not have a simple algebraic expression and is usually solved for using numerical methods.

The assumption underlying the IRR method is that all project cash flows are reinvested at the IRR itself. This assumption is significant because it sets a benchmark for the project's efficiency in generating returns on reinvested cash flows. If the actual reinvestment rate is lower than the IRR, the project may not achieve the expected level of profitability.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3492 The management of Reed Corporation recently announced it will invest \$1 million worth of funds for the research and development of a new project. Assuming that the opportunity cost of capital is 12%, and incremental net cash flows are forecasted as \$160,000 annually in perpetuity, the net present value (NPV) of the project is *closest* to:

- A. \$333,333.33.
- B. \$1,333,333.33.
- C. \$2,333,333.33.

The correct answer is **A**.

To determine the net present value (NPV) of Reed Corporation's investment in a new project, we must consider the perpetual nature of the incremental net cash flows and the opportunity cost of capital. The NPV formula for a perpetuity is given by:

$$NPV = -\text{Initial Investment} + \frac{\text{Annual Cash Flow}}{\text{Discount Rate}}$$

In this case, the initial investment is \$1,000,000, the annual cash flow is \$160,000, and the discount rate (opportunity cost of capital) is 12% or 0.12. Substituting these values into the formula gives:

$$NPV = -\$1,000,000 + \frac{\$160,000}{0.12} = -\$1,000,000 + \$1,333,333.33 = \$333,333.33$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3493 An analyst at YHC Management Inc. has made projections regarding three independent projects, as shown in the exhibit below.

Exhibit: Project Forecasts				
Project	Initial Investment	Year 1 Cash Flow	IRR	NPV
X	\$21,562	\$25,956	60%	\$4,800
Y	\$37,132	\$52,594	50%	\$9,600
Z	\$69,472	\$35,756	55%	\$5,660

Considering that YHC can only invest \$40,000 at the moment and that the net present value

(NPV) is based on a 10% cost of capital, management will *most likely* select:

- A. Project Y.
- B. Project X.
- C. Project Z.

The correct answer is A.

YHC Management Inc. should prioritize the project that offers the highest Net Present Value (NPV). NPV measures the profitability of a project by calculating the difference between the present value of cash inflows and the present value of cash outflows over a period of time. It is a direct indicator of how much value an investment or project will add to the firm. Given that YHC can only invest \$40,000 at the moment and the NPV is calculated based on a 10% cost of capital, the management's decision should be guided by the project with the highest NPV to maximize shareholder wealth.

Project Y, with an initial investment of \$37,132 and an NPV of \$9,600, is the most suitable choice for YHC Management Inc. This project not only fits within the current investment budget but also promises the highest increase in wealth compared to the other options. The NPV of \$9,600 indicates that, after accounting for the cost of capital, Project Y is expected to add \$9,600 in value to the firm, making it the most attractive investment opportunity among the three projects.

B is incorrect. Despite Project X requiring a lower initial investment of \$21,562, its NPV of \$4,800 is significantly lower than that of Project Y. While Project X is within the investment budget, it does not offer the highest value addition compared to Project Y. Therefore, selecting Project X over Project Y would result in a suboptimal allocation of resources, as it would not maximize the potential increase in firm value.

C is incorrect. Project Z, despite having a higher IRR of 55% compared to Project Y's 50%, is not the optimal choice due to its NPV of \$5,660, which is lower than Project Y's NPV. Additionally, Project Z requires an initial investment of \$69,472, which exceeds YHC's current investment capacity of \$40,000. This makes Project Z an unfeasible option regardless of its IRR or NPV. The decision to invest should be based on the NPV criterion when comparing projects with different scales of investment and cash flow profiles, as NPV directly measures the value addition to the firm. In this scenario,

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3495 Walrus Firm is planning to enter into a joint venture with a subsidiary company, which will require the firm to invest \$12 million. The subsidiary will pay Walrus \$2.5 million for three years. At the end of the fourth year, Walrus will buy back the subsidiary for \$9 million. If the CFO of Walrus has in mind a discount rate of 10% for this proposal, the net present value (NPV) of

this proposal is *closest to*:

- A. -\$11,929,991.12.
- B. \$70,008.88
- C. \$364,251.08.

The correct answer is **A**.

To calculate the Net Present Value (NPV) of Walrus Firm's investment proposal, we need to discount all future cash flows back to their present value using the given discount rate of 10%. The NPV calculation involves summing the present values of all cash inflows and outflows associated with the investment. The formula for NPV is given by:

$$NPV = \sum_{t=0}^n \frac{C_t}{(1+r)^t}$$

Where:

- C_t is the cash flow at time t ,
- r is the discount rate, and
- n is the number of periods.

For Walrus Firm's investment:

- The initial investment at $t=0$ is -\$12 million,
- The annual cash inflows for the first three years ($t=1,2,3$) are \$2.5 million each, and
- The cash outflow at the end of the fourth year ($t=4$) due to buying back the subsidiary is -\$9 million.

Substituting these values into the NPV formula, we get:

$$NPV = -\$12 \text{ million} + \frac{\$2.5 \text{ million}}{1.1} + \frac{\$2.5 \text{ million}}{1.1^2} + \frac{\$2.5 \text{ million}}{1.1^3} + \frac{-\$9 \text{ million}}{1.1^4} = -\$11,929,991.12$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3501 Harry Williams works in the corporate finance division of Big Electricals Limited. Williams is working on two investment opportunities, as shown in the following exhibit.

Exhibit: Big Electricals Limited - Potential Investments

Investment A		Investment B	
NPV	\$10,000,000	NPV	\$14,000,000
IRR	12.5%	IRR	10%

The top management has informed Williams that, due to resource constraints, the company would take only one of the two investment opportunities based on Williams' recommendation. If the cost of capital is 8%, then Williams must recommend to the company:

- A. Investment A.
- B. Investment B.
- C. Investment A and B.

The correct answer is **B**.

When faced with a decision between two investment opportunities, Harry Williams should recommend Investment B to the top management of Big Electricals Limited. This recommendation is based on the comparison of the Net Present Value (NPV) of both investments. NPV measures the profitability of an investment by calculating the difference between the present value of cash inflows and the present value of cash outflows over a period of time.

It is a direct indicator of how much value an investment or project adds to the firm. Given that Investment B has a higher NPV (\$14,000,000) compared to Investment A (\$10,000,000), it suggests that Investment B is expected to add more value to the company, making it the preferable choice.

A is incorrect. While Investment A has a higher Internal Rate of Return (IRR) of 12.5% compared to Investment B's IRR of 10%, the decision should not be solely based on IRR when the NPVs are conflicting. Since the cost of capital is 8%, both investments surpass the required rate of return, but the higher NPV of Investment B indicates it is the superior choice in terms of adding value to the company.

C is incorrect. Although both investments have positive NPVs and IRRs greater than the cost of capital, indicating that they are profitable, the company's resource constraints necessitate choosing only one of the two opportunities. Therefore, recommending both Investment A and B is not feasible under the given circumstances.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3519 Which of the following is *most* accurate?

- A. A project can have multiple net present values and internal rates of return.
- B. A project can have multiple net present values, but only a unique internal rate of return.
- C. A project can have multiple internal rates of return, but only a unique net present value.

The correct answer is **C**.

The IRR is the discount rate that makes the NPV of all cash flows from a particular project equal to zero. In cases where a project has unconventional cash flows, meaning there are multiple sign changes in the cash flow sequence (e.g., an initial outflow followed by inflows, and then followed by significant outflows again), the project can have multiple IRRs. Therefore, it is possible for a project to have multiple internal rates of return due to the mathematical properties of the IRR calculation.

A is incorrect. While it is true that a project can have multiple IRRs under certain conditions, the NPV of a project for a given discount rate is unique. The NPV calculation involves discounting the expected cash flows by a specific rate and subtracting the initial investment, leading to a singular value that represents the project's net value to the firm.

B is incorrect. It is calculated based on a specific set of cash flows and a singular discount rate. Conversely, the IRR can have multiple values if the project has unconventional cash flows, leading to a polynomial equation with more than one real root.

CFA Level I, Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3521 The expected annual cash flows from a project are given in the following exhibit.

Exhibit: Expected Annual Cash Flows

Cash Flows	Amount
CF0	-\$10,000
CF1	+\$10,000
CF2	+\$6,000
CF3	+\$5,000

If the required rate of return is 10%, then the net present value (NPV) of the project is *closest to*:

- A. \$7,806.16.
- B. \$17,806.16.
- C. \$27,806.16.

The correct answer is A.

To calculate the Net Present Value (NPV) of a project, we need to discount each of the project's expected cash flows back to their present value using the required rate of return, and then sum these present values. The formula for NPV is given by:

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1+r)^t}$$

where CF_t is the cash flow at time t , r is the required rate of return, and n is the number of periods. Applying this formula to the given cash flows and a required rate of return of 10%, we get:

$$NPV = -10,000 + \frac{10,000}{(1+10\%)^1} + \frac{6,000}{(1+10\%)^2} + \frac{5,000}{(1+10\%)^3} = 7,806.16$$

This calculation takes into account the time value of money, which is essential in evaluating the profitability of investment projects. By discounting future cash flows back to their present value, we can assess the net benefit of the project in today's dollars, providing a clear indicator of its financial viability.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3522 Consider the following mutually exclusive projects:

Project Stellar		Project Regard	
NPV	\$2,800,010	NPV	\$3,452,005
IRR	22%	IRR	18%

As the CFO of the company, you will *most likely* undertake:

- A. Project Stellar.
- B. Project Regards.
- C. Projects Stellar and Regards.

The correct answer is **B**.

When faced with mutually exclusive projects, the primary decision criterion should be the Net Present Value (NPV) rather than the Internal Rate of Return (IRR). This is because NPV directly measures the increase in value to the firm, reflecting the additional wealth created by undertaking the project. In this scenario, Project Regard has a higher NPV (\$3,452,005) compared to Project Stellar (\$2,800,010), indicating that it is expected to add more value to the company. Therefore, based on the NPV criterion, Project Regard should be selected.

A is incorrect. Although Project Stellar has a higher IRR (22%) compared to Project Regard (18%), this does not necessarily mean it is the better choice. The IRR is a relative measure of return and does not account for the scale of the investment or the absolute amount of value created. Since the projects are mutually exclusive, the decision should be based on which project adds more value to the firm, which is indicated by the NPV. In this case, Project Regard, with its higher NPV, is the preferable option despite its lower IRR.

C is incorrect. The option to undertake both Projects Stellar and Regard is not viable since the projects are mutually exclusive, meaning the company must choose one or the other but cannot implement both. This exclusivity necessitates a choice based on which project contributes more to the firm's value, which, as explained, is determined by comparing their NPVs.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3523 Shares of ILL are currently trading at \$70 per share. The company recently announced that it would undertake a project with an expected NPV of \$8 million. If the company has 1 million outstanding shares, then the share price of the company after undertaking the project will *most likely* be:

- A. \$8.
- B. \$70.
- C. \$78.

The correct answer is C.

When a company undertakes a project with a positive Net Present Value (NPV), it indicates that the project is expected to add value to the company beyond its cost. In this scenario, the company is undertaking a project with an expected NPV of \$8 million. The NPV is a direct measure of how much value this project will add to the company.

Given that the company has 1 million outstanding shares, the increase in the company's value can be evenly distributed across all shares. This distribution results in an increase in share price, calculated as follows:

$$\text{Increase in share price} = \frac{\text{NPV of the project}}{\text{Number of outstanding shares}} = \frac{\$8 \text{ million}}{1 \text{ million shares}} = \$8 \text{ per share}$$

Therefore, the new share price after undertaking the project would be the sum of the current share price and the increase per share, which is:

$$\text{New share price} = \text{Current share price} + \text{Increase in share price} = \$70 + \$8 = \$78$$

This calculation shows that the share price of the company after undertaking the project will most likely be \$78.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3525 A logistics company has a fleet of 10 vehicles, and the estimated useful life of each vehicle is approximately 10 years. Due to the shortage of funds, the company decides to sell one of its vehicles after six years. The vehicle was purchased at \$17,500 by another freight company. The vehicle's expected cash flows for its remaining useful life (at the end of each year) are given in the exhibit below.

Useful Life Left	Expected Cash Flows
Year 1	\$10,000
Year 2	\$7,500
Year 3	\$5,000
Year 4	\$5,000

Assuming a discount rate of 10%, was it worth it for the freight company to buy the vehicle based on NPV criteria?

- A. No.
- B. Yes.
- C. The NPV criterion cannot be used to determine the vehicle's worth.

The correct answer is **B**.

Recall that the NPV is given by:

$$NPV = \sum_{t=1}^N \frac{CF_t}{(1+r)^t} - Outlay$$

Where:

- CF_t = after-tax cash flow at time t
- r = required rate of return for the investment
- Outlay = investment cash flow at time zero

The PV of the expected cash flows from the truck is:

$$NPV = \frac{10,000}{(1+10\%)} + \frac{7,500}{(1+10\%)^2} + \frac{5,000}{(1+10\%)^3} + \frac{5,000}{(1+10\%)^3} - \$17,500 = \$4,960.90$$

Since, $NPV > 0$, the investing of the particular was worth it!

Alternatively, candidates can arrive at the NPV using the financial calculator as shown below.

[CFO=-17,500, CF1= 10,000, CF2=7,500, CF3=5,000, CF4=5,000]

(Press "ENTER" after every CF, then press the down arrow twice (once for CF1)

After inputting all CFs, press "CPT" "NPV" and input I as 10. Scroll down once using the down arrow, then press "CPT" to get the NPV as 4960.9.

A is incorrect. The NPV of the vehicle is positive, implying that investing in the vehicle added profits to the company. It was, therefore, a worthy investment.

C is incorrect. We can use the NPV criterion to determine if an investment was worth it or not. If the NPV is positive, the investment was worth it. The opposite is true.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3533 JILL Corp. is planning to launch a new hair product. The company expects an initial capital expenditure of \$80,000 and an annual advertising expense of \$20,000 for the next five years. The product is expected to generate annual sales of \$40,000 for five years. Calculate the project's net present value given a required rate of return of 10%.

- A. -\$4,184.26
- B. \$4,184.26
- C. \$75,815.74

The correct answer is A.

The incremental cash flows if the project is launched are given below.

	Inflows	Outflows	Net Flows
Year 0	-	\$80,000	-\$80,000
Year 1	\$40,000	\$20,000	+\$20,000
Year 2	\$40,000	\$20,000	+\$20,000
Year 3	\$40,000	\$20,000	+\$20,000
Year 4	\$40,000	\$20,000	+\$20,000
Year 5	\$40,000	\$20,000	+\$20,000

$$NPV = -\$80,000 + \frac{\$20,000}{1.1^1} + \frac{\$20,000}{1.1^2} + \frac{\$20,000}{1.1^3} + \frac{\$20,000}{1.1^4} + \frac{\$20,000}{1.1^5} = -\$4184.26$$

We can arrive at the same answer using the financial calculator as shown below. [CF0=-80,000, CF1=(-20,000+40,000) = 20,000, F01=5]

Then press "CPT" "NPV," input I as 10, then press "CPT" to get the NPV as -4,184.26

Note: F01=5 implies that the company will receive the preceding cash flow five times. Instead of using the "F" function, a candidate can still use the "CF" function and input all cashflows. The "F" function shortens the procedure.

B is incorrect. The NPV is negative, not positive, implying that the project is not a profit maximization project and should therefore not be undertaken.

C is incorrect. C represents the present value of the project's cash flows (including the outflows as from year 1), not the project's NPV. The NPV can be obtained by subtracting the initial cash outflow from the present value of the project's inflows.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3534 A firm has the option to buy either Machine A or Machine B. Both machines have the same useful lives, but Machine-A is \$10,000 more expensive than Machine B. For the first three years, Machine A is expected to produce \$45,000 in sales. Then, its production is expected to slow down to only \$36,000 in sales for the remaining two years of useful life. Machine B is expected to produce \$42,000 in sales for all of its useful life.

Assuming a required rate of 10%, the company should *most likely*:

- A. Purchase Machine A.
- B. Purchase Machine B.
- C. Purchase none of the machines.

The correct answer is **B**.

The incremental cash flows if Machine A is purchased instead of Machine B:

	Incremental Cash Flow if Machine A is Purchased (Machine A's Cash Flow - Machine B's Cash Flow)	Remark
Year 0	-\$10,000	Machine A is \$10,000 more costly than Machine B
Year 1	+\$3,000	Machine A will generate \$3,000 more sales than Machine B
Year 2	+\$3,000	Machine A will generate \$3,000 more sales than Machine B
Year 3	+\$3,000	Machine A will generate \$3,000 more sales than Machine B
Year 4	-\$6,000	Machine A will generate \$6,000 less sales than Machine B
Year 5	-\$6,000	Machine A will generate \$6,000 less sales than Machine B

The incremental cash flows if machine B is purchased instead of machine A.

	Incremental Cash Flow if Machine B is Purchased (Machine B's Cash Flow - Machine A's Cash Flow)	Remark
Year 0	\$10,000	Machine B is \$10,000 less costly than Machine A
Year 1	-\$3,000	Machine B will generate \$3,000 less sales than Machine A
Year 2	-\$3,000	Machine B will generate \$3,000 less sales than Machine A
Year 3	-\$3,000	Machine B will generate \$3,000 less sales than Machine A
Year 4	\$6,000	Machine B will generate \$6,000 more sales than Machine A
Year 5	\$6,000	Machine B will generate \$6,000 more sales than Machine A

$$NPV \text{ of Machine A} - NPV \text{ of Machine B} = -10,000 + \frac{3,000}{1.1^1} + \frac{3,000}{1.1^2} + \frac{3,000}{1.1^3} - \frac{6,000}{1.1^4} - \frac{6,000}{1.1^5} = -\$:$$

Using a financial calculator: [CF]=-10,000, CF1= 3,000, CF2=3,000, CF3=3,000, CF4=-6,000, CF5=-6,000]

Press "CPT" "NPV" and input "I" as 10. Then scroll down once and press "CPT" to get the NPV as -10,363.0527

We can also use the financial calculator to determine the NPV if machine B is purchased in place of machine A.

[CF0= 10,000, CO1 = -3,000, CO2 = -3,000, CO3 = -3,000, CO4=6,000, CO5 =6,000] Press "CPT" "NPV" and input "I" as 10. Then scroll down once and press "CPT" to get the NPV as 10,363.0527

Therefore, machine B must be purchased since the NPV its incremental cash flows is positive, implying that machine B will generate profits for the company.

A is incorrect. The NPV of machine A's incremental cash flows is negative, implying that machine A will not profit the company.

C is incorrect. The company should purchase machine B. The NPV of the incremental cash flows of machine B is positive, implying that machine B will generate profits for the company.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3535 The expected annual cash flows from a project are given in the following exhibit.

Exhibit: Expected Annual Cash Flows

Cash Flows	Amount
CF0	-\$5,000
CF1	+\$4,000
CF2	-\$3,000
CF3	+\$10,000

If the required rate of return is 8%, then the NPV of the project is *closest to*:

- A. -\$4,070.01.
- B. \$4,070.01.
- C. \$9,070.01.

The correct answer is **B**.

The Net Present Value (NPV) of a project is a crucial financial metric used to evaluate the profitability of an investment. It represents the difference between the present value of cash inflows and the present value of cash outflows over a period of time. The NPV can be calculated using the formula:

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1+r)^t}$$

Given the expected annual cash flows from the project and a required rate of return of 8%, we can calculate the NPV as follows:

$$NPV = -5,000 + \frac{4,000}{1.08^1} - \frac{3,000}{1.08^2} + \frac{10,000}{1.08^3} = \$4,070.01$$

We can equally solve this using the financial calculator.

[CF0=-5,000, CF1=4,000, CF2=-3,000, CF3=10,000]

Press "CPT" "NPV" and input "I" as 8.

Then scroll down once and press "CPT" "NPV" to get the NPV as 4,070.009653 rounded off to 4,070.01.

A is incorrect. The NPV of the project is positive, not negative, implying that the project is profit-maximizing.

C is incorrect. C represents the present value of the project's cash flows (including the cash outflow in the second year) NPV is obtained by subtracting the initial cash outflow from the project's cash flows.

CFA Level I, Topic 4- Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3966 Which of the following is *least likely* a step in the capital allocation process?

- A. Idea generation.
- B. Investment analysis.
- C. Going concern projects.

The correct answer is **C**.

Going concern projects are a type of capital project. They are required to maintain the business. Other types of capital projects include regulatory/compliance projects, expansion projects, and other projects.

A and B are incorrect. The steps in the capital allocation process are:

- i. **Idea generation:** This is the generation of investment ideas.
- ii. **Investment analysis:** This involves the evaluation of investments' profitability.
- iii. **Capital allocation planning:** This is funding investments that best fit a company's strategy.
- iv. **Monitoring and post-audit:** This is the comparison of expected and actual results and taking any corrective measures.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.3968 An investment has the following cash flows:

Period	Cash Flow at the End of Period
1	\$500,000
2	\$750,000
3	\$900,000

If the investments initial cash outflow is \$1,200,000 with a discount rate of 9%, the net present value is *closest to*:

- A. \$283,970.
- B. \$584,940.
- C. \$1,783,970.

The correct answer is **B**.

To calculate the Net Present Value (NPV) of an investment, we discount all expected future cash flows back to their present value and subtract the initial investment. The formula for NPV is given by:

$$NPV = -\text{Initial Investment} + \sum_{t=1}^n \frac{CF_t}{(1+r)^t}$$

where CF_t is the cash flow at time t , r is the discount rate, and n is the number of periods. For this investment, the initial cash outflow is \$1,200,000, the discount rate is 9%, and there are cash inflows at the end of years 1, 2, and 3. Applying the given values to the NPV formula:

$$NPV = -1,200,000 + \frac{500,000}{(1.09)^1} + \frac{750,000}{(1.09)^2} + \frac{900,000}{(1.09)^3} = 584,940$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3969 The *least* appropriate statement concerning capital rationing is that the technique:

- A. has the potential to violate market efficiency.
- B. may prohibit managers from overspending their budgets.
- C. cannot be used when a company's capital budget is limited.

The correct answer is **C**.

Capital rationing is a financial technique used by companies to select the most profitable projects when the capital budget is limited. It involves prioritizing projects to ensure that the available capital is allocated in a manner that maximizes the company's value.

The least appropriate statement concerning capital rationing is that it cannot be used when a company's capital budget is limited. It helps in making strategic decisions on how to allocate limited resources among competing projects to achieve the best possible returns.

A is incorrect. While it's true that capital rationing can lead to the allocation of resources to projects that may not have the highest possible returns in an unconstrained environment, this does not necessarily violate market efficiency. Market efficiency pertains to the idea that asset prices fully reflect all available information.

Capital rationing is a budgeting and internal decision-making process that does not directly impact market prices or efficiency. However, it can lead to suboptimal investment decisions from a broader market perspective if it prevents investment in projects that would offer higher returns but require more capital than is available.

B is incorrect. By setting a cap on the amount that can be spent on projects, capital rationing imposes discipline on investment decisions and ensures that only the most valuable projects are funded. This can prevent overinvestment and inefficient allocation of resources. There are two types of capital rationing: soft and hard.

Soft capital rationing allows for some flexibility, permitting managers to exceed their budgets if the additional investments are deemed profitable. Hard capital rationing, on the other hand, imposes a strict limit on the amount that can be spent, regardless of the potential profitability of additional projects. Both forms aim to control spending and ensure that investments are made judiciously.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.3970 Consider a company considering a project with the following characteristics:

- The initial outlay is \$155,000.

- The project life is three years.
- The annual after-tax operating cash flows have a 50% probability of being \$25,000 per year and a 50% probability of being \$75,000 per year.
- At the end of the first year, all parties will find out whether project X is a success (cash flow 75,000) or failure (cash flow 25,000).
- The salvage value at termination is zero, and the required rate of return is 11%.

The company has the option of abandoning the project after one year, at which point it would have a salvage value of \$120,000. What's the expected NPV for project X considering the abandonment strategy?

- A. -24,369.37
- B. \$1,954.67
- C. \$28,278.70

The correct answer is **B**.

To evaluate the expected Net Present Value (NPV) of project X considering the abandonment strategy, we must first calculate the NPV under both success and failure scenarios and then find the expected NPV by considering the probabilities of each scenario.

In the success scenario, where the annual after-tax operating cash flows are \$75,000 for each of the three years, the NPV can be calculated using the formula for NPV, which is the sum of the present values of all cash flows associated with the project, including the initial outlay. The formula for NPV is given by:

$$NPV = -\text{Initial Outlay} + \sum_{t=1}^n \frac{CF_t}{(1+r)^t}$$

Where:

- CF_t is the cash flow at time t
- r is the required rate of return
- n is the number of periods

If the project is a success,

$$NPV = -155,000 + \frac{75,000}{1.11^1} + \frac{75,000}{1.11^2} + \frac{75,000}{1.11^3} = \$28,278.70$$

If the project is a failure,

$$NPV = -155,000 + \frac{25,000}{1.11^1} + \frac{120,000}{1.11^1} = -\$24,369.37$$

The expected NPV is then,

$$0.5 \times 28,278.70 + 0.5 \times -24,369.37 = 1,954.67$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.3971 Which of the following is most likely the process used by a company to make capital investment decisions.

- A. Capital allocation process.**
- B. Monitoring and post-audit.**
- C. Capital allocation planning.**

The correct answer is A.

The capital allocation process is the method a company uses to distribute its financial resources among different potential investments, projects, or divisions. This process is crucial for a company's long-term success and growth, as it determines how the company's capital will be invested to generate the highest possible returns.

The capital allocation process involves several steps, including the identification of potential investment opportunities, the analysis and evaluation of these opportunities based on their expected returns and risks, and the decision-making process regarding which investments to pursue. This process ensures that the company's resources are used efficiently and effectively, supporting strategic objectives and maximizing shareholder value.

B is incorrect. Monitoring and post-audit refer to the steps taken after an investment has been made. These activities are crucial for evaluating the performance of the investment against expectations and for learning lessons that can be applied to future capital allocation decisions. However, they do not represent the entire process used by a company to make capital investment decisions but are rather components of the broader capital allocation process.

C is incorrect. Capital allocation planning is an important part of the capital allocation process, focusing on the strategic planning aspect of how resources are to be distributed among various projects or investments. While it is a critical component, it does not represent the full scope of the process. Planning involves setting priorities and determining the allocation of capital based on the company's strategic objectives and available resources.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.3972 Which of the following is *least likely* a step of the capital allocation process?

- A. Generating an idea.
- B. Creating a firm-wide capital budget.
- C. Hiring a new team for project management.

The correct answer is **C**.

Capital allocation is the process of identifying and analyzing projects which will generate cash flows for a firm for over at least a year.

The four steps of the capital allocation process are:

- i. **Idea generation:** Idea generation is the most important step of the capital allocation process. Ideas can be generated from within or from outside the company. Ideas can come from either the top or bottom management or any department from within the company.
- ii. **Investment analysis:** Future cashflows are forecasted and analyzed to determine the project's profitability.
- iii. **Capital allocation planning:** The profitable proposals are organized into a whole that fits the company's overall strategies. The projects' timings are also considered at this step.
- iv. **Monitoring and post-audit:** Actual results are compared to the forecasted results, and any differences This last step helps monitor the forecasts and analysis that underlie the capital allocation process and improve business operations. It also helps analysts in the production of concrete ideas for future investments.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.3973 Which of the following project proposals is most likely categorized under the capital allocation process?

- A. Replacing the current engines of the Istanbul airplanes fleet to reduce carbon dioxide emissions.
- B. Replacing pencils by buying a new brand of pencils for the employees in the head office of a textile manufacturing firm
- C. Increasing the internet data package of a company providing car cleaning services for a temporary period of 4 months.

The correct answer is **A**.

The capital allocation process involves strategic decision-making where companies decide how to invest their finite resources in various projects or assets that are expected to generate returns over time. This process is crucial for the growth and sustainability of a company. Among the given options, replacing the current engines of the Istanbul airplanes fleet to reduce carbon dioxide emissions is most likely categorized under the capital allocation process.

This project involves a significant investment in capital assets with the expectation of long-term benefits, including compliance with environmental regulations, potential savings on fuel due to increased efficiency, and a positive impact on the company's public image.

B is incorrect. Buying a new brand of pencils for employees does not constitute a capital allocation decision. This action represents a routine operational expense rather than an investment in long-term assets. Operational expenses such as office supplies do not generate direct returns over time in the same way that capital investments do.

C is incorrect. Increasing the internet data package for a temporary period of 4 months is an operational decision rather than a capital allocation decision. This action is aimed at addressing a short-term need and does not involve investing in long-term assets that generate returns over time. The temporary nature of this expense and its focus on operational efficiency rather than strategic growth or return on investment further distinguishes it from capital allocation decisions.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.3976 Which of the following is *most likely* a principle of the capital allocation process?

- A. Cash flows are based on opportunity costs.
- B. Cash flows are analyzed on a before-tax basis.
- C. Financing costs of projects are deducted separately.

The correct answer is **A**.

Principles of capital allocation.

- i. Decisions are based on incremental cash flows and not on accounting concepts such as net income.
- ii. Cash flows are based on opportunity cost. What are the incremental cash flows that come with the project compared to what they would have been minus the project?
- iii. The timing of cash flows is critical.
- iv. Cash flows are analyzed on an after-tax basis.
- v. Financing costs are ignored since they are already reflected in the required rate of return.
- vi. The capital allocation cash flows are not the same as accounting net income.

As seen above, the most likely principle of the capital allocation process of the three given choices is that cash flows are based on opportunity costs.

B is incorrect. The cash flows of a capital allocation process are analyzed on an after-tax and not on a before-tax basis.

C is incorrect. Financing costs of a capital allocation process are ignored since they are already reflected in the required rate of return.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.4097 Which of the following is *least likely* a type of business maintenance capital project?

- A. Expansion projects.
- B. Regulatory projects.
- C. Going concern projects.

The correct answer is **A**.

Expansion projects are primarily aimed at growing the size and scope of a business, rather than maintaining its current operational capacity. These projects can include launching new product lines, entering new markets, or acquiring other companies. The primary goal of expansion projects is to increase the company's market share and profitability, which inherently involves a higher level of risk and investment compared to maintenance projects.

Expansion projects are strategic decisions made by a company to enhance its competitive position and long-term financial performance. They often require significant capital investment and may lead to changes in the company's business model or operational processes.

B is incorrect. Regulatory projects are indeed a type of business maintenance capital project. These projects are undertaken to ensure that a company complies with laws, regulations, and standards set by governmental or regulatory bodies. Failure to comply with these regulations can result in legal penalties, fines, or other adverse consequences for the business.

Therefore, regulatory projects are essential for maintaining the legal and operational status of a company, ensuring that it can continue its current operations without interruption. Examples of regulatory projects include upgrading facilities to meet new environmental standards or implementing new safety protocols.

C is incorrect. Going concern projects are also a type of business maintenance capital project. These projects are essential for the continuous operation of the business and are aimed at maintaining or slightly improving the existing operational efficiency and capacity. They do not significantly alter the size or scope of the business but are crucial for ensuring that the company remains viable and competitive in its current market.

Examples of going concern projects include replacing outdated machinery, repairing critical infrastructure, or upgrading software systems to improve operational efficiency. These projects help a business maintain its competitive edge and operational effectiveness without expanding into new markets or significantly changing its business model.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.4098 Which of the following is *most likely* an option that allows a company to delay its investment decisions instead of investing now?

- A. Timing options.
- B. Flexibility options.
- C. Fundamental options.

The correct answer is **A**.

Timing options are a strategic tool that companies can utilize to defer their investment decisions to a future date. This option is particularly valuable in environments of uncertainty, where waiting for more information can significantly influence the outcome of the investment. By choosing to delay an investment, a company can gather additional data, observe market trends, and make a more informed decision.

This approach can lead to better allocation of resources and potentially higher returns on investment. Timing options essentially provide companies with the flexibility to invest at an optimal time, rather than committing capital prematurely.

B is incorrect. Flexibility options, while valuable in their own right, do not specifically address the strategic decision to delay investment. These options are more related to operational flexibility, such as adjusting production levels or prices in response to market conditions.

While flexibility options can enhance a company's ability to respond to changes, they do not encapsulate the strategic decision-making process involved in choosing when to invest. Therefore, suggesting flexibility options as the answer misunderstands the specific nature of timing options in the context of investment decisions.

C is incorrect. Fundamental options refer to situations where the investment itself can be viewed as an option, often seen in research and development projects. These options are about the inherent value and potential of the investment, rather than the timing of the investment decision.

While fundamental options are crucial in strategic investment planning, they do not directly address the concept of delaying investment to gather more information or wait for more favorable conditions.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (d): Describe types of real options relevant to capital investments.

Q.4100 Which of the following is the *most appropriate* definition of inertia in relation to capital allocation pitfalls?

- A. Failing to consider alternative investments.
- B. Increasing capital investments every period with falling investment returns.
- C. Management considers internally generated capital differently from externally generated capital.

The correct answer is **B**.

Inertia is one of the common pitfalls of the capital allocation process. This is when management increases its capital investments each period while the investment returns remain the same or decline. Management should be questioned on the justification of its capital investments and whether they should be considering alternative uses of capital.

A is incorrect. Failing to consider alternative investments is another common capital allocation pitfall. While considering good investment ideas, many alternatives may not be considered or even many different scenarios. Other common pitfalls include a source of capital bias, pushing pet projects, basing investment decisions on EPS, net income, or ROE, and internal forecasting errors.

C is incorrect. Management considering internally generated capital differently from externally generated capital falls under a source of capital bias. This is where management may treat internally generated capital as “free” compared to externally generated capital and allocate it similarly to previous periods. Management should treat all capital as having an opportunity cost.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.4101 An investment has the following cash flows:

Year	Cash Flows
0	-300,000
1	120,000
2	160,000
3	-120,000
4	200,000

Using a required rate of return of 11%, the investment’s NPV is *closest to*:

- A. -18,029

B. 60,000

C. 157,459

The correct answer is **A**.

To calculate the Net Present Value (NPV) of an investment, we discount all future cash flows back to their present value using the required rate of return and then sum these values, including the initial investment. The formula for NPV is given by:

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1+r)^t}$$

where CF_t is the cash flow at time t , r is the required rate of return, and n is the number of periods.

Given the cash flows and a required rate of return of 11% (or 0.11), we can calculate the NPV as follows:

$$NPV = -\frac{300,000}{(1+0.11)^0} + \frac{120,000}{(1+0.11)^1} + \frac{160,000}{(1+0.11)^2} - \frac{120,000}{(1+0.11)^3} + \frac{200,000}{(1+0.11)^4}$$

Calculating each term:

$$NPV = -300,000 + \frac{120,000}{1.11} + \frac{160,000}{1.2321} - \frac{120,000}{1.367631} + \frac{200,000}{1.518748} = \$18,029$$

The investment would result in a net loss of \$18,029 when considering the required rate of return of 11%.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.4102 Which of the two following projects should Theme Pharmaceuticals *most likely* undertake considering a required rate of return of 8%?

	Project A	Project B	Project C
Year 0	-150,000	-200,000	-40,000
Year 1	80,000	150,000	20,000
Year 2	30,000	-50,000	25,000
Year 3	100,000	160,000	30,000

- A. Project A
- B. Project B
- C. Project C

The correct answer is **A.**

To determine which project Theme Pharmaceuticals should undertake, we calculate the Net Present Value (NPV) of each project using a required rate of return of 8%. NPV is a method used in capital budgeting to analyze the profitability of a projected investment or project. The formula for NPV is:

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1+r)^t}$$

where CF_t is the cash flow at time t , r is the discount rate (required rate of return), and n is the number of periods.

Project A has cash flows of -150,000 at Year 0, 80,000 at Year 1, 30,000 at Year 2, and 100,000 at Year 3. Using the required rate of return of 8%, the NPV calculation for Project A is:

$$NPV_A = -\frac{150,000}{(1+0.08)} + \frac{80,000}{(1+0.08)^1} + \frac{30,000}{(1+0.08)^2} + \frac{100,000}{(1+0.08)^3} = 29,177$$

Project B has cash flows of -200,000 at Year 0, 150,000 at Year 1, -50,000 at Year 2, and 160,000 at Year 3. The NPV calculation for Project B is:

$$NPV_B = -\frac{200,000}{(1+0.08)} + \frac{150,000}{(1+0.08)^1} - \frac{50,000}{(1+0.08)^2} + \frac{160,000}{(1+0.08)^3} = 23,035$$

Project C has cash flows of -40,000 at Year 0, 20,000 at Year 1, 25,000 at Year 2, and 30,000 at Year 3. The NPV calculation for Project C is:

$$NPV_C = -\frac{40,000}{(1+0.08)} + \frac{20,000}{(1+0.08)^1} + \frac{25,000}{(1+0.08)^2} + \frac{30,000}{(1+0.08)^3} = 23,767$$

Given the NPV calculations, Project A has the highest NPV of 29,177, making it the most profitable project for Theme Pharmaceuticals to undertake, considering the required rate of return of 8%.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.4103 Which of the following is the *most likely* an example of an externality?

- A. Sunk costs.
- B. Cannibalization.
- C. Conventional cash flows.

The correct answer is **B**.

Cannibalization refers to a situation where a new product or service significantly reduces the sales and market share of an existing product within the same company. This phenomenon is considered a negative externality because it represents an unintended consequence that affects the company's overall performance negatively, without being directly related to the costs of producing or marketing the new product.

Externality, in economic terms, is an effect of a purchase or use decision by one set of parties on others who did not have a choice and whose interests were not taken into account. Cannibalization impacts the company's internal ecosystem by diminishing the value of existing products due to the introduction of a new product, thus fitting the definition of an externality.

A is incorrect. They remain constant regardless of the outcome of future decisions. The concept of sunk costs does not involve external effects on third parties or other products within the same company, which is a key characteristic of externalities. Therefore, sunk costs do not represent an example of an externality, as they are purely related to past financial decisions without directly impacting others outside of those decisions.

C is incorrect. Conventional cash flows describe a pattern of cash flow movements over time, typically characterized by an initial investment outlay followed by a series of positive cash inflows. This concept is fundamental in capital budgeting and investment analysis but does not inherently involve any external effects on third parties or unintended consequences outside the scope of the investment itself.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.4104 Which of the following is *most likely* a definition of return on invested capital (ROIC)?

- A. This is the rate that a project's IRR must exceed for the project to be accepted by the company.
- B. This is the rate used in discounting cash flows. It is the rate that the suppliers of capital require, given the riskiness of the project.
- C. This is a measure of the profitability of a company or business segment relative to the amount of capital invested by equity and debtholders.

The correct answer is C.

Return on Invested Capital (ROIC) is a financial metric used to evaluate the efficiency of a company in allocating the capital under its control to profitable investments. It measures the company's ability to generate returns from its invested capital, which includes both equity and debt. The formula for calculating ROIC is given by:

$$\text{ROIC} = \frac{\text{Net Operating Profit After Taxes (NOPAT)}}{\text{Invested Capital}}$$

This formula highlights the importance of not just generating profits, but generating them from the effective use of capital. ROIC is a crucial metric for investors and analysts as it provides insight into how well a company is using its capital to generate profits. A higher ROIC value indicates a more efficient use of capital, which is a positive sign for investors looking for companies with sustainable competitive advantages.

A is incorrect. This option describes the hurdle rate, not ROIC. The hurdle rate is the minimum rate of return on a project or investment required by a manager or investor. It represents the lowest acceptable return on an investment, considering its risk. The hurdle rate is used to assess the feasibility of projects and is crucial in the capital budgeting process. It is not a measure of profitability relative to invested capital.

B is incorrect. This option refers to the cost of capital, which is different from ROIC. The cost of capital is the rate of return that a company must earn on its project investments to maintain its market value and attract funds. The cost of capital serves as a benchmark for evaluating investment projects, but it does not directly measure the profitability of a company relative to its invested capital.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.4105 The cash flows from a project are presented in Exhibit 1.

Exhibit 1: Projects Cash Flow

Year	Flows
0	-\$22,000
1	+\$5,000
2	+\$10,000
3	+\$3,000
4	+\$6,000
5	+\$1,000

The IRR of the project is *closest to*:

- A. -10.35%
- B. 3.70%
- C. 5.28%

The correct answer is C.

The Internal Rate of Return (IRR) is a financial metric used to evaluate the profitability of potential investments. It is the discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero.

The IRR can be considered as the break-even interest rate at which an investment yields no profit and no loss. The IRR calculation involves finding the rate (r) that satisfies the following equation:

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1+r)^t} = 0$$

To do this using the financial calculator, IRR can be calculated as:

CF_0 = -22,000,

C01 = 5,000,

C02 = 10,000,

C03 = 3,000,

C04 = 6,000,

C05 = 1000

Then press "IRR" and then "CPT" to get the IRR as 5.28%

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital

(ROIC), and contrast their use in capital allocation.

Q.4107 Which of the following is *least likely* a principle of capital allocation?

- A. Decisions are based on net income.
- B. Measure incremental cash flows.
- C. Decisions are based on incremental cash flows.

The correct answer is **A**.

The capital allocation process is a process that companies use to make decisions on capital projects, i.e., projects with a lifespan of at least one year. It is a cost-benefit process aimed at producing results greater than the cost of capital allocation efforts.

Principles of capital allocation.

- i. Decisions are based on incremental cash flows and not on accounting concepts such as net income.
- ii. Measure incremental cash flows. What are the incremental cash flows that come with the project compared to what they would have been minus the project?
- iii. The timing of cash flows is critical.
- iv. Cash flows are analyzed on an after-tax basis.
- v. Financing costs are ignored.
- vi. The capital allocation cash flows are not the same as accounting net income.

As seen above, capital allocation decisions are not based on net income but on incremental cash flows.

B and C are incorrect. They are principles of capital allocation.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (c): Describe principles of capital allocation and common capital allocation pitfalls.

Q.4670 Assume KKP Corporation is considering a capital investment of \$25 million today. This investment is expected to return after tax cash flows of \$3 million annually for the first four years and \$5 million in the fifth year. If the required rate of return is 9%, what is the NPV of this investment?

- A. -8.00
- B. -12.03
- C. -13.33

The correct answer is **B.**

NPV is a financial metric used to evaluate the profitability of an investment or project. NPV measures the difference between the present value of cash inflows and the present value of cash outflows over a specified time period.

$$NPV = CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \dots + \frac{CF_T}{(1+r)^T}$$

$$NPV = -25 + \frac{3}{(1+0.09)^1} + \frac{3}{(1+0.09)^2} + \frac{3}{(1+0.09)^3} + \frac{3}{(1+0.09)^4} + \frac{5}{(1+0.09)^5}$$

$$NPV = -25 + 9.719 + 3.249 = -12.032$$

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.4671 Under which of the following steps of capital allocation process is the validation of assumptions and production of ideas for future investments most likely occur?

- A. Idea generation
- B. Planning and prioritization
- C. Monitoring and post-investment review

The correct answer is **C**.

In the monitoring and post-investment review stage, projections are compared to the investment's performance, and adjustments are made. There are various reasons why this step is crucial. Initially, it assists in verifying the assumptions involved in the capital allocation procedure, exposing systematic mistakes such as too optimistic projections. Additionally, it might also generate concepts for upcoming investments.

A is incorrect. The idea generation stage of the capital allocation process is a crucial step where potential investment opportunities are identified and evaluated. This stage involves generating ideas for potential projects or investments that could generate returns for the organization.

B is incorrect. The planning and prioritization stage is a crucial part of the capital allocation process where organizations strategically plan and prioritize their investment opportunities. This stage involves assessing the potential projects or initiatives identified during the idea generation stage and determining which ones align best with the organization's goals and objectives.

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.

Q.4672 Assume KKP Corporation intends to make a capital investment of \$120 million today and this investment is expected to have an after-tax cash flow \$28 million per year for the next five years. What is the IRR of this investment?

A. 5.37%

B. 8.57%

C. 9.33%

The correct answer is A.

$$0 = -120 + \frac{28}{(1 + \text{IRR})^1} + \frac{28}{(1 + \text{IRR})^2} + \frac{28}{(1 + \text{IRR})^3} + \frac{28}{(1 + \text{IRR})^4} + \frac{28}{(1 + \text{IRR})^5}$$

Using the financial calculator;

[CF0] = -120

[CF1] = 28

[CF2] = 28

[CF3] = 28

[CF4] = 28

[CF5] = 28

[IRR], [CPT] = 5.3686%

CFA Level I, Topic 4 - Corporate Issuers, Learning Module 5: Capital Investments and Capital Allocation. LOS (b): Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation.
