LO.a: Calculate and interpret the net present value (NPV) and the internal rate of return (IRR) of an investment.

1. The Chinese government wishes to invest in a project that requires an initial investment of $18 million. The project is expected to produce positive cash flows of $5 million for the first three years, and $3 million for the next two years. Given that the required rate of return is 10 percent, the approximate internal rate of return (IRR) of this project is *closest* to:
   A. 2%.
   B. 6%.
   C. 10%.

2. A company is planning to invest $25,000 in a new project. The project is expected to generate annual after-tax cash flows of $5000 for the next 3 years and $15,000 in its fourth year. Given that the appropriate discount rate for this project is 5.5 percent, the NPV of the project is *closest* to:
   A. $598.
   B. $567.
   C. $1,519.

3. The expected cash flows of a project are given below:

Time	Cash Flow ($)
0	(180,000)
1	100,000
2	200,000
3	250,000

   Given that the risk-free rate is assumed to be 3 percent, the market risk premium is 6 percent, the beta for the project is 1.2 and the expected inflation is 2 percent, the investment's net present value (NPV) is *closest to*:
   A. $237,000.
   B. $255,000.
   C. $262,000.

4. Lee Kwan Group is about to invest in a 2-year project that requires an initial outlay of $5 million. The expected cash flows in years 1 and 2 are $3 million and $3.5 million respectively. The internal rate of return of this project is *closest to*:
   A. 18%.
   B. 19%.
   C. 20%.

5. The table below shows the after-tax cash flows of a project:

Year	0	1	2	3	4	5	6
Cash flow (€)	-50,000	35,000	25,000	10,000	2,000	2,000	3,000

   The IRR of the project is *closest* to:
   A. 27%.

B. 29%.
C. 30%.

6. The incremental after-tax cash flows of a project are given below:

Year	0	1	2	3	4
Cash flow (€)	-50,000	25,000	20,000	10,000	3,000

Using 12 percent as the discount rate, the NPV (in €) of the project is *closest* to:
A. -2,710.
B. 1,535.
C. 3,804.

7. Alexander Stan plans to invest $1.5 million in a project today. The project is expected to pay $200,000 per year in perpetuity. The cost of capital is 8 percent. Will Stan benefit by investing in the project, as judged by the NPV rule?
A. No, the project is not worth the investment.
B. Yes, the project is worth the investment.
C. Additional information is required to make the decision.

8. A project requires an initial outlay of $750,000. It is expected to produce $200,000 in the first year, $300,000 in the second year, and $400,000 in the third year. The project's opportunity cost of capital is 10 percent. Which of the following is *most likely* the net present value of the project?
A. $11,833.
B. -$19,722.
C. $769,722.

9. Billy Bowden intends to invest $1.5 million in a project today. The project's expected cash flows are $200,000 per year in perpetuity. The cost of capital is 8 percent. Should Bowden invest in the project based on the IRR rule?
A. No, the project is not worth the investment.
B. Yes, the project is worth the investment.
C. Additional information is required to make the decision.

10. A project requires an initial outlay of $750,000. It is expected to produce cash flows of $200,000 in the first year, $300,000 in the second year, and $400,000 in the third year. The cost of capital for this project is 10%. What is the internal rate of return of the project?
A. 8.65%.
B. 10.00%.
C. 11.00%.

LO.b: Contrast the NPV rule to the IRR rule, and identify problems associated with the IRR rule.

11. As a project manager, Alan Smith has to choose between three mutually exclusive projects: A, B and C. He uses the information given below to evaluate the three projects:

	NPV	IRR	Payback Period
A	$22,000	7.5%	4 years
B	$30,000	8%	4.5 years
C	$25,000	12%	6 years

Based on the information given, the *most* appropriate project for Smith's department is:
A. Project A.
B. Project B.
C. Project C.

12. Ms. Silvio, a corporate finance analyst is considering two mutually exclusive capital budgeting projects with conflicting rankings (one has the higher positive NPV, while the other has a higher IRR). The *most* appropriate project she can choose is the one with the:
A. higher IRR.
B. higher NPV.
C. shorter payback period.

13. Emad Gohar plans to invest in a project that requires an initial investment of $3 million. The project is expected to generate the following cash flows.

Time	Cash flow
1	1.20 million
2	1.05 million
3	0.90 million
4	0.75 million

The cost of capital is 10 percent. Which of the following statements *best* describes the decision Gohar should take based on the NPV and IRR rules?
A. Accept based on the NPV rule, but reject based on the IRR rule.
B. Accept based on the IRR rule, but reject based on the NPV rule.
C. Accept based on either rule.

14. Which of the following reasons will *least likely* lead to a conflicting decision between the IRR rule and the NPV rule for mutually exclusive projects?
A. The size of the projects differs.
B. The timing of the project's cash flows differs.
C. The cost of capital differs.

LO.c: Calculate and interpret a holding period return (total return).

15. Information about a common stock investment is given below:

	Date	Amount €
Stock purchase	15 January 2013	62.00
Cash dividend received	14 July 2013	5.00
Stock sale	15 July 2013	78.00

The holding period return on the common stock investment is *closest to*:
A. 25.80%.
B. 33.87%.
C. 67.74%.

16. Ms. Brown purchased 500 shares of a stock at a price of $20 per share on 1 January. She sold all the stocks on 30 June of the same year at a price of $ 22 per share. She also received dividends totaling $500 on 30 June. The holding period return on the investment is *closest* to:
A. 10%.
B. 15%.
C. 20%.

LO.d: Calculate and compare the money-weighted and time-weighted rates of return of a portfolio and evaluate the performance of portfolios based on these measures.

17. An investor buys two shares of Heather Corporation for $53 per share. He receives an annual dividend of $3 per share at the end of every year for four years. At the end of fourth year, just after receiving his final dividend, he sells both shares of Heather Corporation for $45 per share. The investor's money weighted rate of return is *closest* to :
A. 2.0%.
B. 5.2%.
C. 1.6%.

18. The table below shows information about a common stock:

	Date	Amount €
Stock purchase (1 share)	1 July 2012	54.00
Stock purchase (1 share)	1 July 2013	49.00
Stock sale (2 shares @ 61.00 per share)	1 July 2014	122.00

The stock does not pay a dividend. The money-weighted rate of return on the investment is *closest* to:
A. 11.64%.
B. 11.87%.
C. 12.05%.

19. An investor purchases one share of a stock for $44. Exactly one year later, the company pays a dividend of $4.00 per share. This is followed by two more annual dividends of $5.00 and

$4.50 in successive years. Upon receiving the third dividend, the investor sells the share for $45.0 .The money-weighted rate of return on this investment is *closest* to:
A. 8.45%.
B. 10.87%.
C. 32.95%.

20. An investor purchases 100 shares of a stock. The history of this investment is outlined below:

Time	Activity	Price per Share	Dividend per Share
Begining of Year 1	Buy 100 shares	$20.00	
End of Year 1	Buy 20 shares	$22.00	$2.00
End of Year 2		$25.00	$2.50
End of Year 3	Sell 120 shares	$24.00	

Assuming that the investor does not reinvest his dividends, which are tax-free, the time-weighted rate of return on the investment is *closest* to:
A. 12.92%.
B. 14.71%.
C. 16.50%.

21. Donna Dewberry buys 120 shares of EFL at a price of $75 per share on January 1, 2011. On January 1, 2012, after receiving a dividend of $5 per share, Dewberry sells 60 shares at a price of $80 each. On January 1, 2013, Dewberry receives a dividend of $5 per share on the remaining shares and then sells all of them at $82 each. Which of the following is *most likely* the money weighted return on Dewberry's portfolio?
A. 11.85%.
B. 33.80%.
C. 35.89%.

22. An investor buys one share of a stock at $85 at t = 0. He buys an additional share for $90 at t = 1. The stock pays a dividend of $5 per share at t = 1 and t = 2. The investor sells both the shares at t = 2 for $100 each. Which of the following is *most likely* the money weighted rate of return?
A. 11.34%.
B. 14.18%.
C. 14.94%.

23. An investor buys one share of a stock at $85 at t = 0. He buys an additional share for $90 at t = 1. The stock pays a dividend of $5 per share at t = 1 and t = 2. The investor sells both the shares at t = 2 for $100 each. Which of the following is *most likely* the time weighted rate of return?
 A. 11.34%.
 B. 14.18%.

C. 14.94%.

24. The following table shows the cash flows for a particular portfolio:

Amounts in $	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Beginning balance	2,000,000	3,100,000	3,800,000	4,500,000
Beginning periodic inflow/(outflow)	500,000	450,000	200,0000	(350,000)
Amount invested	2,500,000	3,550,000	4,000,000	4,150,000
Ending balance	3,100,000	3,800,000	4,500,000	4,000,000

Which of the following is *most likely* the annualized time weighted return of the portfolio?
   A. 43.93%.
   B. 8.47%.
   C. 9.50%.

25. Which of the following statements is inaccurate about a time weighted return?
   A. It is unaffected by the timing of cash withdrawals.
   B. It is the internal rate of return.
   C. Its calculation is similar to the calculation of a geometric mean.

26. Mariah Hill buys one share of a stock for $50 on January 1, 2011. She buys an additional share on January 1, 2012 at $60. The stock paid a dividend of $3 per share at the end of each year. On January 1, 2013, she receives $150 for selling the two shares. Which of the following options *most likely* represent the time weighted and money weighted returns?

	Time weighted return	Money weighted return
A.	28.60%	27.98%
B.	27.98%	28.60%
C.	26.80%	29.78%

LO.e: Calculate and interpret the bank discount yield, holding period yield, effective annual yield, and money market yield for US Treasury bills and other money market instruments.

27. A T-Bill with a par value of $100,000 and 120 days to maturity has a bank discount yield of 5.2 percent. The current price of the T-Bill is *closest to*:
   A. $97,490.33.
   B. $98,266.67.
   C. $99,480.00.

28. A 210-day U.S. Treasury bill with a face value of $100,000 sells for $98,000 when issued. Assuming an investor holds the bill to maturity, the investor's money market yield is *closest* to:
   A. 1.19%.

B. 2.04%.
C. 3.50%.

29. The dollar discount on a U.S. Treasury bill with 121 days until maturity is $3,050. The face value of the bill is $100,000. The bank discount yield of the bill is *closest* to:
A. 9.07%.
B. 9.20%.
C. 9.43%.

30. Bill Adams wants to compute the bank discount yield of a T-bill. A T-bill with a face value of $100,000 is selling for $96,500. If there are 120 days until maturity, what is its bank discount yield?
A. 3.50%.
B. 10.50%.
C. 10.64%.

31. A Treasury bill with a face value of PKR 100,000 is selling for PKR 97,000. There are 140 days until maturity. Which of the following is *most likely* the money market yield?
A. 7.71%.
B. 7.95%.
C. 8.06%.

32. A Treasury bill with a face value of PKR 100,000 is selling for PKR 97,000. There are 150 days until maturity. Which of the following is *most likely* the effective annual yield?
A. 7.20%.
B. 7.42%.
C. 7.69%.

LO.f: Convert among holding period yields, money market yields, effective annual yields, and bond equivalent yields.

33. A fixed-income analyst is analyzing a T-bill which has 180 days to maturity and a bank discount yield of 2.35 percent. The effective annual yield of the bond would be *closest* to:
A. 2.37%.
B. 2.40%.
C. 2.43%.

34. A T-Bill with a par value of $100,000 and 90 days to maturity has a bank discount yield of 4.70 percent. The money market yield of the instrument is *closest* to:
A. 4.76%.
B. 4.84%.
C. 4.90%.

35. A Treasury bill offers a bank discount yield of 4.5 percent and has 180 days to maturity. The effective annual yield for the instrument is *closest* to:

A. 4.39%.
B. 4.72%.
C. 4.80%.

Solutions

1. B is correct. Enter the given cash flows in a financial calculator:
    CF_0 = -18 million
    CF_1 = 5 million
    CF_2 = 5 million
    CF_3 = 5 million
    CF_4 = 3 million
    CF_5 = 3 million
    IRR Compute = 6%.

2. A is correct. Enter the given cash flows and discount rate in a financial calculator to calculate NPV:
    CF_0 = -25,000, CF_1 = 5000, CF_2 = 5000, CF_3 = 5,000, CF_4 = 15000, i = 5.5%, CPT NPV.
    NPV = $597.92.

    Alternatively, solve the following equation to calculate NPV
    NPV
    $= -25,000 + (5,000 \div 1.055) + (5,000 \div 1.055^2) + (5,000 \div 1.055^3) + (15000 \div 1.055^4)$
    = $ 597.92 ~ $598.

3. C is correct.
    Opportunity cost of capital for the investment =
    risk free rate + the market risk premium * beta.

    Opportunity cost = 3% + (6% x 1.2) = 10.2%.

    The NPV equals the present value (at time = 0) of the future cash flows discounted at the opportunity cost of capital (10.2%) minus the initial investment, or $123,725. Using a financial calculator, solve for NPV.
    CF_0= −180,000, CF_1= 100,000, CF_2= 200,000, CF_3= 250,000, %i = 10.2, CPT NPV = 262,241.84 ≈ 262,000.

4. B is correct. Using a financial calculator, compute IRR:
    CF_0 = -5,000,000, CF_1 = 3,000,000, CF_2 = 3,500,000; CPT IRR = 18.88% ≈ 19%..

5. A is correct. Using a financial calculator, compute IRR:
    CF_0 = −50,000, CF_1 = 35,000, CF_2 = 25,000, CF_3 = 10,000, CF_4 = 2,000, CF_5 = 2,000, and CF_6 = 3,000, CPT IRR.
    The IRR is 27.05%.

6. A is correct. Enter the given cash flows and the given discount rate into a financial calculator and solve for NPV.

$CF_0 = -50,000$, $CF_1 = 25,000$, $CF_2 = 20,000$, $CF_3 = 10,000$, $CF_4 = 3,000$, $i = 12\%$. Compute PV. The NPV is –2,710.

7. B is correct. $NPV = -CF_0 + \dfrac{\overline{CF}}{r}$

$NPV = -1,500,000 + \dfrac{\overline{200,000}}{0.08} = 1,000,000$

Since the NPV is positive, the project should be accepted.

8. B is correct. Using a financial calculator, enter the following cash flows to compute NPV.
$CF_0 = -750,000$; $CF_1 = 200,000$; $CF_2 = 300,000$; $CF_3 = 400,000$; $I = 10$; CPT NPV = $-19,722$

9. B is correct.

$NPV = -CF_0 + \dfrac{\overline{CF}}{IRR} = 0$

$0 = -1,500,000 + \dfrac{\overline{200,000}}{IRR}$

IRR = 13.33%
Since the IRR is greater than the cost of capital, which is also the opportunity cost, Bowden should invest the project.

10. A is correct. Using a financial calculator, enter the following cash flows to compute IRR.
$CF_0 = -750,000$, $CF_1 = 200,000$, $CF_2 = 300,000$, $CF_3 = 400,000$, CPT IRR = 8.65%.

11. B is correct. Project B has the highest NPV among the three projects and thus results in the greatest addition to shareholder wealth. While there is a conflict among the NPV and IRR rules for projects B and C, NPV rule is to be given preference for its superiority over IRR and hence B would be the most appropriate choice. Payback period should be given the least consideration as it does not affect the decision due to its various drawbacks.

12. B is correct. When the IRR and NPV rules conflict in ranking projects, consider the NPV rule. The NPV of an investment represents the expected addition to shareholder wealth from an investment, and we take the maximization of shareholder wealth to be a basic financial objective of a company.

13. C is correct. Using a financial calculator, enter the following cash flows to compute NPV and IRR.
$CF_0 = -3.0$ million, $CF_1 = 1.2$ million, $CF_2 = 1.05$ million, $CF_3 = 0.90$ million, $CF_4 = 0.75$ million, $I = 10\%$, CPT NPV = 0.147 million, CPT IRR = 12.44%
Since the NPV is positive and the IRR is greater than the cost of capital, both rules indicate that the project should be accepted.

14. C is correct. The size of the project and the timing of the cash flows impact the NPV and the IRR of the projects.

15. B is correct. Holding period return is calculated as follows: $\text{HPR} = \frac{(78 - 62 + 5)}{62} = 33.87\%$. The HPR is not annualized for holding periods shorter than a year.

16. B is correct. $\text{HPR} = \frac{(P1 - P0 + D1)}{P0} = \frac{(22 - 20 + 1)}{20} = .15 = 15\%$

17. A is correct. Money-weighted rate of return is the internal rate of return (IRR) of the cash flows resulting from the investment activity.
    To calculate the money weighted rate of return for the investor, using financial calculator enter the following cash flows:
    $CF_0 = (-53 \times 2) = -106$, $CF_1 = 6$, $CF_2 = 6$, $CF_3 = 6$, $CF_4 = 6 + (45 * 2) = 96$, Compute IRR:
    IRR = 1.998% ~ 2.0%.

18. A is correct. The money-weighted rate of return is the IRR based on the cash flows related to the investment. In this case, a cash outflow of €54 occurs at t = 0, another outflow of €49 occurs at t = 1, and an inflow of €122 occurs at t = 2. Using a financial calculator, the IRR of these cash flows is 11.64%.

19. B is correct. The money-weighted rate of return is the internal rate of return (IRR) of the cash flows associated with the investment. Using a financial calculator, compute IRR.
    $CF_0 = -44$, $CF_1 = 4$, $CF_2 = 5$, $CF_3 = 49.50$, compute IRR. IRR = 10.87%.

20. A is correct. TWR = $\sqrt[3]{\{[(22 + 2)/20] * [(25 + 2.5)/22] * [(24/25)]\}} - 1 = 0.1292$.

21. A is correct. Calculate the outflows and inflows on every significant date:

    Outflows:
    On January 1, 2011: 120 shares * $75 per share = $9000
    Inflows:
    On January 1, 2012:
    Dividend on 120 shares: 120 * $5 per share = $600
    Sale of 60 shares: 60 * $80 per share = $4800, Total = $5400
    On January 1, 2013
    Dividend on remaining 60 shares: 60 * $5 per share = $300
    Sale of 60 shares: 60 * $82 per share = $4920
    Total = $5220
    IRR is the money weighted return which can be calculated using the cash flows:
    $CF_0 = -9000$; $CF_1 = 5400$; $CF_2 = 5220$, CPT IRR = 11.85%
    The money weighted return is equal to 11.85%.

22. C is correct. Calculate the outflows and inflows at t = 0, t = 1 and t = 2.
    Outflows:
    At t = 0: $85
    At t = 1: $90

Inflows:
At t = 1: $5 * 1 = $5
At t = 2: $5 * 2 = $10
At t = 2: $100 * 2 = $200
Using a financial calculator, calculate the IRR.
$CF_0 = -85$, $CF_1 = -85$, $CF_2 = 210$, CPT IRR = 14.94%.

23. B is correct.
Value of the stock at various time periods:
At t = 0, $85
At t = 1, $90 + $5 = $95
At t = 2, $200 + $10 = $210
HPR:
$$HPR_1 = \frac{90 + 5}{85} - 1 = 11.76\%$$
$$HPR_2 = \frac{200 + 10}{90 * 2} - 1 = 16.67\%$$
Time weighted return = $[(1 + r_1)(1 + r_2)(1 + r_3)\,.....\,(1 + r_N)]^{\frac{1}{N}} - 1$
$[(1.1176)(1.1667)]^{0.5} - 1 = 14.18\%$
The time weighted return is equal to 14.18%.

24. A is correct. Calculate the holding period return for every period:
HPR:
$$HPR_1 = \frac{3,100,000 - 2,500,000}{2,500,000} = 24.00\%$$
$$HPR_2 = \frac{3,800,000 - 3,550,000}{3,550,000} = 7.04\%$$
$$HPR_3 = \frac{4,500,000 - 4,000,000}{4,000,000} = 12.50\%$$
$$HPR_4 = \frac{4,000,000 - 4,150,000}{4,150,000} = -3.61\%$$
Since the returns are for each quarter, we simply need to link the returns:
1.24 * .10704 * 1.1250 * 0.9639 = 1.4393. The annualized time weighted return is equal to 43.93%.

25. B is correct. The time weighted rate of return is not the internal rate of return. Statements A and C are correct.

26. B is correct. To determine the time-weighted return, calculate the holding period return.
HPR:
$$HPR_1 = \frac{60 + 3}{50} - 1 = 26\%$$
$$HPR_2 = \frac{150+6}{60*2} - 1 = 30\%$$
Time weighted return = $[(1 + r_1)(1 + r_2)(1 + r_3)\,.....\,(1 + r_N)]^{\frac{1}{N}} - 1$

$[(1.26)(1.30)]^{0..5} - 1 = 27.98\%$
The time weighted return is equal to 27.98%
Outflows:
At t = 0, $50
At t = 1, $60
Inflows:
At t = 1: $3 * 1 = $3
At t = 2: $3 * 2 = $6
At t = 2: $150
Using a financial calculator, compute IRR.
$CF_0 = -50, CF_1 = -57, CF_2 = 156$, CPT IRR = 28.60 %.
The money weighted return is equal to 28.60%.

27. B is correct. The dollar discount is: $1,733.33 = 0.052 * 100,000 * \left(\frac{120}{360}\right)$. The price would be $98,266.67 = 100,000 - 1,733.33$.

28. C is correct. The money market yield is: $3.50\% = \left[\left(\frac{100,000}{98,000}\right) - 1\right] * \left(\frac{360}{210}\right)$.

29. A is correct. Solve for bank discount yield using:
$r_{BD} = \frac{D}{F} * \frac{360}{t}; = \frac{3050}{100000} * \frac{360}{121} = 0.09074$ or 9.07%

30. B is correct.

$\text{Bank Discount Yield} = \left(\frac{\text{Discount}}{\text{Face Value}}\right) * \left(\frac{360}{\text{Days to maturity}}\right)$

$\text{Bank Discount Yield} = \left(\frac{3500}{100,000}\right) * \left(\frac{360}{120}\right) = 10.50\%$

31. B is correct. $r_{MM} = HPR * \frac{360}{t} = \left(\frac{100,000}{97000} - 1\right) * \frac{360}{140} = 7.95\%$.

32. C is correct.
$EAY = (1 + HPY)^{\frac{365}{t}} - 1$

$HPY = \frac{P_1 - P_0 + D_1}{P_0}$

$HPY = \frac{100,000 - 97,000 + 0}{97,000} = 3.092\%$

$EAY = (1 + 0.03092)^{\frac{365}{150}} - 1 = 7.69\%$.

33. C is correct.
$r_{BD} = \frac{D}{F} * \frac{360}{t}; 0.0235 = \frac{D}{100} * \frac{360}{180}; D = 1.175$
$P_0 = 100 - 1.175 = 98.825$
$HPY = \frac{P_t - P_0}{P_0} = \frac{100 - 98.825}{98.825} = 0.0118897$

$EAY = (1+HPY)^{365/t} - 1 = (1+0.0118)^{365/180} - 1 = 2.4257\%$.

34. A is correct. The money market yield is: $4.76\% = \frac{360 * 0.047}{[360 - (90) * (0.047)]}$.

The more intuitive method is to first calculate the HPY and then use the HPY to calculate the money market yield. To calculate the HPY, we need the discount, D: $0.047 = (D/100,000) * 360/90$. D = 1,175. P = 98,825. HPY = 1,175/98,825 = 0.01189.

Money market yield = $0.01189 * \frac{360}{90} = 0.0476$.

35. B is correct. First, calculate the initial price (P_0) of the T-bill:
$0.045 = \frac{D}{100} * \frac{360}{180}$
$D = 2.25$
$P_0 = 100 - 2.25 = 97.75$

Then, calculate the holding period yield (HPY) (recall that T-bills are pure discount instruments and do not pay coupons):
$HPY = (P_t - P_0) \div P_0$
$HPY = \frac{100 - 97.75}{97.75} = 0.023$
Finally, convert the HPY into effective annual yield:
$EAY = (1 + HPY)^{365/t} - 1$
$EAY = (1 + 0.023)^{365/180} - 1 = 0.04719 = 4.72\%$.