School of Business and Economics

Exam: Finance
Code: E_IBA2_FIN

Examinator: Dr. M.B.J. Schauten
Co-reader: Prof. Dr. M.J. van den Assem

Date: 17 December 2020
Time: 18.45-20.45 hrs
Duration: 2 hours

Calculator allowed: yes
Graphical calculator allowed: no
Scrap paper allowed: yes
Open book exam: no

Type of questions: 16 multiple choice and 3 open (consisting of 6 subquestions in total)

Answer in: English

Remarks:
Answer the **multiple choice questions** by filling the corresponding box. For each question, only one answer is correct (a, b, c or d). Answer all questions (giving no answer = giving a wrong answer). The answers to the **open questions** should be written in the space below the open questions. Numbers are in European (Dutch) format with decimal commas, and dots separating thousands (e.g. 1.234.567,89).

If you have to show a calculation when answering an open question, use "SQRT" followed by the number (e.g. SQRT(4) for the square root of 4). When using an exponent, use the "^" character followed by the exponent (e.g. 3^2 for 3 to the power 2). For multiplication use "×" or “*” and for dividing use ":" or "/". For addition and subtraction use "+" and "-" as usual. When in doubt, also feel free to just describe your computation in words.

Credit score:
The maximum score for the mc questions is 72 points. To determine the score we take into account the expected number of correct answers when answers are given randomly. The maximum score for the open questions is 18 points. The final grade for this exam is: [total number of points + 10] / 10.

Grades:
At the latest the grades will be made public on 14 January 2021

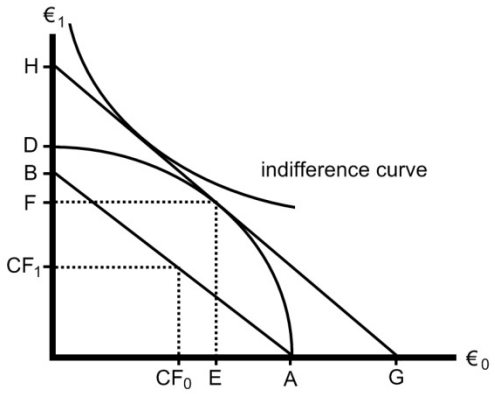
Inspection:
tba

If you have **not** signed up for this exam, you will not receive a result. Through VUnet you can object to the fact that you can no longer sign up after the expiry of the registration deadline (and the fact that you will not receive a result for this exam). Submit your appeal online within one week after the exam. More information can be found at www.vu.nl/intekenen.

Part A: Multiple choice questions (72 points)

Number of points mc questions = (number of correctly answered questions – 4) × 6

1.
Assume a world according to the Hirshleifer model. The net present value of the real investment projects is €50,00. At t = 0 the income of Dieter is €100,00 (CF_0) and at t = 1 it is €102,00 (CF_1). The risk-free interest rate is 2,00%. Consider the figure below, which is not drawn to scale.

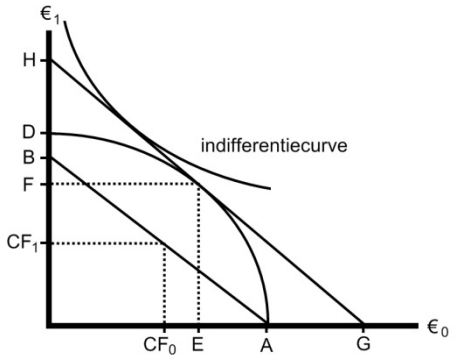


Question: The maximum consumption at t = 1 (OH) is closest to

a. €250
b. €255
c. €260
d. €265

Answer: b
OG = CF0 + CF1/(1+r) + NPV = 100 + 102/1,02 + 50 = 250
OH = OG × (1+r) = 250 ×1,02 = 255

2.
Assume a world according to the Hirshleifer model. At t = 0 the income of Julie is €80,00 (CF_0) and at t = 1 it is €30,60 (CF_1). At t = 0 Julie consumes €30,00 (C_0) and at t = 1 €255,00 (C_1). The risk-free interest rate is 2,00%. At t = 0 Julie invests €60,00 in real investment projects. Consider the figure below which is not drawn to scale.



Question: The present value of the proceeds of the real investment projects (EG) is closest to

a. €210
b. €220
c. €230
d. €240

Answer: c
$OG = CF_0 + CF_1/(1+r) + NPV$
$OG = C_0 + C_1/(1+r) = 30 + 255/1{,}02 = 280$
$OG = CF_0 + CF_1/(1+r) + NPV = 80 + 30{,}60/1{,}02 + NCW = 280 \rightarrow NPV = 280\text{-}110 = 170$
$NPV = -I + PV(OF) = 170 \rightarrow PV(OF) = 170 + I = 170 + 60 = 230$

3.

For project FIATI, the expected cash flows in euros before tax are shown in the table below. The corporate tax rate is 25%. Ignore other taxes. The investment outlay (at t = 0) for project FIATI amounts to €150 and is depreciated straight-line over three years to zero. The discount rate is 8,00%.

Table 1: Expected cash flows in euros before tax

t	**CF_t**
0	–150
1	50
2	120
3	60

Question: The net present value of the project is closest to

a. €15
b. €27
c. €30
d. €47

Answer: c

	0	1	2	3
CF before tax	€ (150,00)	€ 50,00	€ 120,00	€ 60,00
Depreciation		€ 50,00	€ 50,00	€ 50,00
Profit before tax		€ -	€ 70,00	€ 10,00
Tax		€ -	€ 17,50	€ 2,50
CF after tax	€ (150,00)	€ 50,00	€ 102,50	€ 57,50
PV(CFs)	€ (150,00)	€ 46,30	€ 87,88	€ 45,65
NPV	€ 29,82			

4.
Company HelloFris is considering to invest in a new project that now (t = 0) requires an investment of €40.000. The expected cash flows before corporate tax (in nominal terms) at the end of year 1 and 2 are €25.000 and €35.000 respectively. The investment of €40.000 is depreciated to zero on a straight-line basis over 2 years, based on historical cost. The firm expects to sell the machine at t = 2 for €2.000 (in nominal terms). The corporate tax rate is 25,00%. Ignore other taxes. The real cost of capital is 5,00%. The expected inflation is 2,00%.

Question: The net present value of the project is closest to

a. €9.200
b. €9.420
c. €10.132
d. €10.727

Answer: d

		0	1	2
CF before tax	€	(40.000,00)	€ 25.000,00	€ 35.000,00
Depreciation			€ 20.000,00	€ 20.000,00
Proft before tax			€ 5.000,00	€ 15.000,00
Tax			€ 1.250,00	€ 3.750,00
CF after tax			€ 23.750,00	€ 31.250,00
Proceeds divestment before tax				€ 2.000,00
tax over profit divestment				€ 500,00
Proceeds divestment after tax				€ 1.500,00
Total CF after tax			€ 23.750,00	€ 32.750,00
PV(CF after tax)	€	(40.000,00)	€ 22.175,54	€ 28.551,73
NPV	**€**	**10.727,26**		

De discount rate in nominal terms is: $(1{,}05 \times 1{,}02) - 1 = 7{,}1\%$

5.
During the lecture on the valuation of bonds, the terms 'risk premium' and 'credit spread' were discussed. Assume a perfect capital market.

Question: Which of the following statements is **true**?

a. ‘Risk premium’ is defined as the difference between the yield to maturity and the required return.
b. ‘Risk premium’ is defined as the difference between the required return and the risk-free rate.
c. ‘Credit spread’ is the same as the yield to maturity.
d. ‘Credit spread’ is defined as the difference between the expected return and the required return.

Answer: b
c.d. Credit spread or default spread is the difference between the yield to maturity and the risk free rate.

6.
Consider project MarMar. The project is expected to generate an annual cash flow of €100,00 over the next 4 years. The required return is 10,00% and the risk-free interest rate is 2,00%.

Question: Which of the statements below is **true**?

a. The certainty equivalent of the cash flow at t = 1 is €89,73.
b. The certainty equivalent of the cash flow at t = 2 is €80,98.
c. The certainty equivalent of the cash flow at t = 3 is €76,73.
d. The certainty equivalent of the cash flow at t = 4 is €73,93.

Answer: d
certainty equivalent CFt = [(1+rf)^t/(1+r)^t] × CFt
certainty equivalent CF1= [(1,02)^1/(1,1)^1] × 100 = 92,73
certainty equivalent CF2 = [(1,02)^2/(1,1)^2] × 100 = 85,98
certainty equivalent CF3 = [(1,02)^3/(1,1)^3] × 100 = 79,73
certainty equivalent CF4 = [(1,02)^4/(1,1)^4] × 100 = 73,93

7.
Assume a perfect capital market and a downward sloping term structure of interest rates. The one-year spot rate (r_1) is 6,00%. Both bond A and bond B have a remaining maturity of 6 years and a nominal value of €1.000,00. Bond A is a zero-coupon bond and bond B has a coupon of 5,00%. Both bonds have no default risk.

Question: Which of the following statements is **true**?

a. The yield to maturity of bond A is lower than that of bond B.
b. The yield to maturity of bond A is higher than that of B.
c. The yield to maturity of bond A is the same as that of B.
d. It is not possible to draw any conclusion about the sign of the difference between the yield to maturities of the two bonds.

Answer: a
The yield of A is similar to r6. Because the term structure of interest rates is declining, the yield of B, the bond with a coupon, is higher. The price and yield of this bond is determined by r1-r6.

8.
Assume an efficient capital market. Consider three bonds in this world. Bond A has a coupon of 2,00%, bond B of 3,00% and bond C of 4,00%. The maturity of bond A is 1 year, of bond B 2 years and of bond C 3 years. The bonds are free of default risk. The price of bond A as well as that of bond B is €1.000,00. The nominal value of each of the bonds is €1.000,00. The forward rate for year 3 ($_2f_3$) is 4,00%.

Question: The price of bond C is closest to

a. €1.010
b. €1.013
c. €1.016
d. €1.019

Answer: d

$P_A = 1.020/(1+r_1) = 1.000 \rightarrow r_1 = 2{,}0\%$
$P_B = 30/(1+r_1) + 1.020/(1+r_2)^2 = 30/(1{,}02) + 1.020/(1+r_2)^2 = 1.000 \rightarrow r_2 = 3{,}0152\%$
$P_C = 40/(1+r_1) + 40/(1+r_2)^2 + 1.040/(1+r_2)^2(1+{}_2f_3) = 40/(1{,}02) + 40/(1{,}030152)^2 + 1.040/(1{,}030152)^2\,(1{,}04) = 1.019{,}23$

9.

Company Maximilien N.V. is engaged in the operation of gyms. Over the past few years, earnings per share have been constant. This is not very surprising, because there was no investment in growth. Instead of using the profits to invest in growth, Maximilien paid out the total profits in the form of dividends (the pay-out ratio was 100%). The current share price is €75,00 (P_0 = €75,00) and, as last year, the expected earnings per share for the coming year are €6,00 (EPS_1 = €6,00).

However, there is an unexpected change on the way. At t = 0 the board of Maximilien decides to permanently reduce the pay-out ratio from 100% to 60% starting at t = 1 and to use the retained earnings (40%) annually to invest in new gyms. The first expansion investment takes place at t = 1 and amounts to €2,40 per outstanding share (40% of EPS_1). Assume a return on investment of 10% on these expansion investments ('roni' = 10%). At t = 0, the board of Maximilien announces the unexpected change of policy regarding the dividend and the investment program.

The company's business risk will not be affected by the policy change. Maximilien N.V. has been and will continue to be fully financed with equity. The required return on equity is 8,00%.

Question: Which of the following statements is **true**?

a. At the time of announcement of the policy change, Maximilien N.V.'s share price increases from €75 to €85.
b. At the time of announcement of the policy change, Maximilien N.V.'s share price increases from €75 to €90.
c. At the time of announcing the policy change, Maximilien N.V.'s share price increases from €75 to €80.
d. At the time of announcing the policy change, Maximilien N.V.'s share price decreases from €75 to €60.

Answer: b
g = retention ratio ×roni = 40% × 10% = 4%
P0 = div1 / (r-g) = k × EPS1 / (r-g) = (60% × 6,00) / (0,08 – 0,04) = 90

10.
Consider a world where the assumptions of the portfolio theory hold. In this world, only two risk-bearing securities are traded, securities A and securities B. Short-selling is permitted.

The risk of security A expressed as the standard deviation of the return is 25,00%, the risk of security B is 40,00%. The expected return of A is 25,00% and the expected return of B 40,00%. The correlation coefficient between the returns of A and B is 0,50.

Question: The expected return of the portfolio with the lowest level of risk (MRP) is closest to

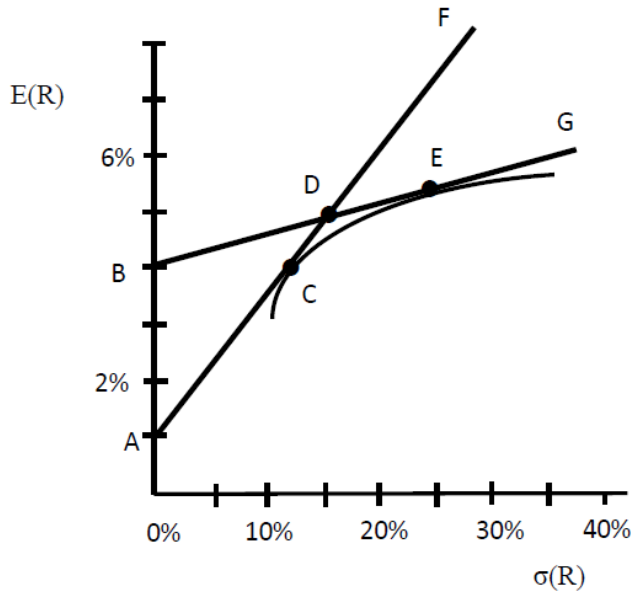
a. 32%
b. 21%
c. 25%
d. 27%

Answer: d

Xa = (variance RB – cov(RA,RB))/((variance RA) + (variance RB) – 2 × cov(RA,RB))
= (0,40^2 – (0,25×0,40×0,5)) / (0,25^2 + 0,40^2 – (2×0,25×0,40×0,5)) = 0,8980

$E(RP) = x_A \times E(R_A) + x_B \times E(R_B) = 0,8980 \times 25\% + 0,102 \times 40\% = 26,53\%$

11.
Consider a world where the assumptions of the portfolio theory hold. Consider the figure below. The curve through C and E is the efficient frontier of risk-bearing securities in this world. In this world it is possible to lend against OA and to borrow against OB. The risk of C (σ_C) is 12%.



Question: Which of the following statements is **true**?

a. The efficient frontier runs from A to D and from D in the direction of G.
b. The efficient frontier runs from A to C and then from C along the curve to E and then from E towards G.
c. Portfolio D can be composed by borrowing against OB.
d. The risk (measured in terms of the standard deviation of its return) of a portfolio that consists for 50% of a long position in C and for 50% of a long position in A equals 8%.

Answer: b.
c. Portfolio D can't be constructed.
d. The risk of a portfolio consisting for 50% of a long position in C and for 50% of a long position in A equals 0,5 ×12% = 6%.

12.
Assume a world in which the assumptions of the CAPM hold. In this world, in addition to a risk-free investment object F with a return of 2,00%, only the three risk-bearing securities A, B and C are traded:

Security	**A**	**B**	**C**
E(R)	4,00%	6,00%	8,00%
Number of outstanding shares	40.000	20.000	40.000
Current price per share	€ 5,00	€ 20,00	€ 10,00

The risk of the market portfolio (M) expressed as the standard deviation of the return is 24,00%. The equity of investor MAX who operates optimally in this world is €20.000,00. Investor Max has invested €5.000,00 of this amount risk-free and the remainder in M.

Question: The number of shares A in MAX's portfolio is the closest to

a. 500
b. 600
c. 800
d. 900

Answer: b
Fraction of A in M is: (40.000 × 5) / [(40.000 × 5) + (20.000 × 20) + (40.000 ×10)] = 0,2
Max invests 15.000 in M which implies an investment in A of 0,2 × 15.000 = 3.000 in A.
The number of shares A is 3.000 / 5 = 600 pcs.

13.
Assume a world in which the assumptions of the CAPM hold. Consider in this world two MV-efficient portfolios A and B. The expected return of A is 20,00%, that of B 5,00% and that of market portfolio M 10,00%. The risk-free interest rate is 2,00%. The risk of M expressed as the standard deviation of its return is 24,00%.

Question: Which of the following statements is **true**?

a. The beta of A is 2,00.
b. The beta of B is 0,375.
c. The correlation coefficient between the returns of A and M is higher than the correlation coefficient between the returns of B and M.
d. The standard deviation of the return of A equals 2 times the standard deviation of the return of M.

Answer: b
a. False. The beta of A is 2,25 (SML: 20% = 2% + β (10%-2%) → β = 2,25)
b. True. The beta of B is 0,375 (SML: 5% = 2% + β (10%-2%) → β = 0,375)
c. False. They are both 1.
d. False.

According to the CML the following applies:
$E(Ri) = Rf + [(E(RM) – Rf) / \sigma(RM)] \times \sigma(Ri) \rightarrow$
$\sigma(Ri) = (E(Ri) – Rf) / [(E(RM) – Rf) / \sigma(RM)] = (20\%-2\%) / [(10\%-2\%)/24\%] = 54\%$

or

$\beta = \sigma(Ri)/ \sigma(RM)$

since SML: $20\% = 2\% + \beta (10\%-2\%) \rightarrow \beta = 2,25$

$2,25 = \sigma(Ri)/ 24,00\% \rightarrow \sigma(Ri)=2,25*24,00\%=54\%$

14.

Assume a perfect capital market. Euroma N.V. has three different divisions. For the Chemicals division, the management of Euroma N.V. determines the cost of capital on the basis of a comparable listed company.

For comparable company DCM Chemicals N.V., Euroma's management has estimated the beta of equity and debt. The beta of DCM Chemicals' equity is 1,2. The beta of DCM Chemicals' debt is 0,2. DCM Chemicals is 40% financed with debt (market value of debt / (market value of debt plus market value of equity) = 40%) and has a substantial excess of liquid assets. The value of the excess cash is 30% of the sum of the market value of debt and the market value of equity. These liquid assets are risk-free.

The risk-free interest rate is 2,00% and the market risk premium is 6,00%. Ignore taxes. Euroma's management applies the CAPM when determining the cost of capital. Euroma is fully financed with equity and does not have excess cash at its disposal.

Question: The cost of capital (RA) of Euroma's chemical division is closest to

a. 8,9%
b. 7,0%
c. 12,2
d. 5,3%

Answer: a
XCash / (MVE+MVD) × 0 + [value risky assets / (MVE+MVD)] × beta risky assets = MVD/(MVE+MVD) × 0,2 + MVE/(MVE+MVD) × 1,2 = 0,4 × 0,2 + 0,6 × 1,2 = 0,8
→
XCash / (MVE+MVD) × 0 + [value risky assets / (MVE+MVD)] × beta risky assets = 0,8
→
beta risky assets = (0,8 - XCash / (MVE+MVD) × 0) / [value risky assets / (MVE+MVD)] = (0,8 – 0,3 × 0) / [0,7] = 1,1428571
RA = Rf + βrisky assets (E(RM)-Rf) = 2,00% + 1,1428571 (6%) = 8,857%

15.

Question: Which of the following statements is **true**?

a. If the realised return on a certain share in a certain year is higher than the expected return on that share, the market is not efficient in the semi-strong form of the Efficient Market Hypothesis.
b. A market that is efficient in the weak form of the Efficient Market Hypothesis is by definition also efficient in its semi-strong form.
c. Application of technical analysis (studying historical price movements) in a market that is efficient in the weak form of the of the Efficient Market Hypothesis is expected to generate systematically positive abnormal returns.
d. The realised return on shares with a beta > 1 can be higher or lower than the realised return on the market portfolio in a semi-strong efficient market.

Answer: d

a. False. The actual return will almost always deviate from the expected return.
b. False. A market that is efficient in its weak form can be inefficient in its semi-strong form.
c. False. In such a market, all the information that can be obtained through technical analysis is already correctly reflected in the prices of shares.
d. True.

16.

Company B is about to take over Company T.

The market value of the equity and debt of Company B and T as a stand-alone entity is shown in the table below.

Table 1: Market value in millions of euros of the equity and debt of company B and T as a stand-alone entity

	B	T
Equity	400	100
Debt	0	400
Total	400	500

The acquisition will be financed by the issuance of new B shares. Immediately after the acquisition of T by B, the current shareholders of B will have a 80% interest in the company's equity and the current shareholders of T will have a 20% interest. The synergies of the acquisition amount to €50 million. As a result of the acquisition, the market value of T's debt increases from €400 mln to €405 mln.

Question: The net present value of the acquisition for the current shareholders of B is closest to

a. €9 mln
b. €36 mln
c. €41 mln
d. €45 mln

Answer: b

Balance sheet B after the acquisition of T

D	BT		C
Value assets B	400	Equity	545
Value assets T	500	Debt	405
Synergies	50		
Total	950	Total	950

Market value equity held by shareholders B: 80% × 545 = 436
NPV for shareholders B is: 436-400 = 36
NB:
Market value equity held by shareholders T: 20% × 545 = 109
NPV for shareholders T is: 109-100 = 9

On the following pages you will find part B: the open questions

Part B: Open quistions (18 points)

17. (6 points)

Question:

a.

Willem's aunt deposits €500,00 into a savings account at the time of Willem's birth and every year after that up until 5th birthday (6 times €500,00). The annual interest rate is 7,2% and remains constant.

Calculate the amount that is in the savings account on his 5th birthday (i.e. including the deposit on his birthday). Round off your answer to whole euros (e.g. €12). You do not have to show your calculation. (3 points)

Answer

FV $= (A/R(1-(1+R)^{-T}) + A)\times(1+R)^5$

$= [(500/0{,}072\ (1-(1{,}072)^{-5}) + 500] \times(1{,}072)^5 =$ € 3.594,72

or

500 × 1,072^5 + 500 × 1,072^4 + 500 × 1,072^3 + 500 × 1,072^2 + 500 × 1,072^1 + 500 = € 3.594,72

b.

The following is known about project X. The investment outlay at t=0 is €10.000. The expected cash flow at t=1 is €1.000 and increases indefinitely by 2,00% annually. The required rate of return is 10%. Assume a perfect capital market. Calculate the internal rate of return of the project. Round off to two decimal places (e.g. 1,23%) and show your calculation. (3 points)

Answer:

NPV = - 10.000 + 1.000/(IRR-g) = 0 → IRR = 12,00%

18. (6 points)
Assume an efficient capital market. In this market, bonds issued by BasicFat are traded. The nominal value per bond is €1.000, the remaining maturity is 1 year and the coupon 0%. Given the probability of default, investors assume an expected cash flow at t =1 of €945,00 per bond. The one-year spot rate (r_1) is 2,00%. The price of the bond is at t = 0 €900,00.

Question:

a. Calculate the yield to maturity of a BasicFat bond. Round off to two decimal places (e.g. €1.23) and show your calculation. (3 points)

18a
Answer:

P_0 = promised CF / (1+y) = 900 = 1000/(1+y) → y =11,11%

b. Determine the return expected by the capital market on a BasicFat bond. Round off to two decimal places (e.g. 1.23%) and show your calculations. (3 points)

18b
Answer:
P_0 = expected CF / (1+r) = 900 = 945 /(1+r) → r =5,00%

19. (6 points)
The following is known about company A and B as stand-alone companies:

	A	**B**
P/E ratio	25	7,5
Earnings per share (EPS)	€ 1,00	€ 2,00
Number of shares	400.000	250.000
Market value equity	€ 10.000.000	€ 3.750.000
Price at t = 0	€ 25	€ 15

Company A is about to acquire company B. The offer is entirely in new shares of A, with shareholders of B receiving 3 new A shares for every 5 shares they own. The synergies resulting from the acquisition of B by A amounts to €1,0 mln. Both companies are fully equity financed.

Question:

a. Calculate the net present value of the acquisition for the shareholders of A. Round off your answer to whole euros (e.g. €12). You do not have to show your calculation. (3 points)

19a
Answer
NPV = value after the merger in the hands of A - value before the merger in the hands of A
Number of new shares to be issued is: (250.000/5) × 3 = 150.000
Value A after acquisition B = 10.000.000 + 3.750.000 + 1.000.000 = 14.750.000
Group company owned by A after acquisition: 400.000/(400.000+150.000) = 0,727272
Value in hands A after acquisition B = 0,727272 × 14.750.000 = 10.727.273
PV = 10.727.273 – 10.000.000 = 727.273

b. Imagine that company A does not pay the shareholders of B with shares but with €4.000.000 from its excess cash. Re-calculate the net present value for the shareholders of A. Round off your answer to whole euros (e.g. €12). You do not have to show your calculation. (3 points)

19b
Answer
NPV = value after the merger in the hands of A - value before the merger in the hands of A
Value A after the acquisition of B = 10.000.000 + 3.750.000 + 1.000.000 - 4.000.000 = 10.750.000
NPV = 10.750.000 – 10.000.000 = 750.000
Or
NPV = gain – cost = 1.000.000 – (4.000.000 - 3.750.000) = 750.000