School of Business and Economics

Exam: Finance (resit)
Code: E_IBA2_FIN

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

Date: 17 March 2021
Time: 16.00 – 18.00 hours
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 questions
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 for the square root of that number (e.g. SQRT(4) for the square root of 4). For 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, 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 31 March 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: MC Questions (72 points)

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

1.
Assume a world according to the Hirshleifer model. Lois' income at t = 0 and t = 1 is €60,00 (CF_0) and €40,80 (CF_1) respectively. The risk-free interest rate is 2,00%. At t = 1 Lois pays €1,00 in interest. Lois' consumption at t = 0 is €55,00. At t = 1, the income from the real projects is €71,40.

Question: The net present value of the real investment projects is closest to

a.   €15
b.   €20
c.   €25
d.   €30

Answer: a
At t = 1 Lois pays €1,00 in interest → At t = 0 Lois borrows €1,00/0,02 = €50,00.
At t = 0 the investment in real projects is: CF_0 – C_0 + borrowed amount = 60 – 55 + 50 = 55.
NPV of the real projects is -55 + 71,40 / 1,02 = 15

2.

Assume a world according to the Hirshleifer model. Quintus' income at t = 0 is €120,00 (CF$_0$) and at t = 1 his income is €81,60 (CF$_1$). At t = 0, Quintus invests €75,00 in real projects (EA). At t = 0, Quintus consumes €140,00 (C$_0$) and at t = 1 he consumes €91,80 (C$_1$). The risk-free interest rate is 2,00%. Consider the figure below which is not drawn to scale.
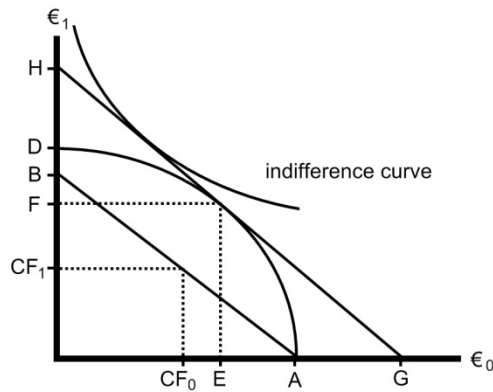
Question: At t = 1 the proceeds of the investments in real projects (OF) is closest to

a.   €100
b.   €107
c.   €110
d.   €115

Answer: b

OG = C$_0$ + C1/(1+r) = 140 + 91,80/1,02 = 230

OG = OA + AG = CF$_0$ + CF$_1$/(1+r) – I + PV(proceeds) = 230

120 + 81,60/1,02 – 75 + PV(proceeds) = 230 → PV(proceeds) = 230 – 125 = 105

The proceeds at t = 1 are 105 × 1,02 = 107,1

3.

Assume a perfect capital market. You are considering investing in a start-up company. The founder has asked you for €300.000 today (t = 0) and you expect to get €1.230.000 in 11 years (t = 11). You neither receive nor pay cash flows between t = 0 and t = 11. Given the riskiness of the investment opportunity, the cost of capital is 30%.

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

a.   You should invest in the project since the internal rate of return is 12,69%.
b.   You should invest in the project since the internal rate of return is 112,69%.
c.   You should not invest in the project because the net present value is negative.
d.   You should not invest in the project since the profitability index is higher than 1.

Answer: c

a.b.   The IRR is 13,69% since $-I + CF_{11}/(1+IRR)^{11} = 0$
c.   The NPV of the project is: $-I + CF_{11}/(1+IRR)^{11} = -300.000 + 1.230.000/1,30^{11} = -231.367,75 \rightarrow$ you should not invest.
d.   False. The PI = PV / I = 68.632,25/300.000 = 0,23. PI < 1 and not > 1. Besides, if PI > 1 you should invest.

4.

Assume a perfect capital market. Assume that an investment project requires €125.000 (at t = 0) and that the project is expected to generate a perpetually growing cash flow from t = 3 onwards. The cash flow at t = 3 is €10.000. The annual growth rate is 3,00% (the cash flow at t = 4 is €10.000 × 1,03 etc.). The cash flow at t =1 is €0 and at t = 2 €6.000. The internal rate of return (IRR) of the project is 10,14% and the required rate of return is 8,00%.

Question: The net present value and profitability index of the project are closest to

a.   €49.642 and 1,32 respectively
b.   €51.612 and 1,32 respectively
c.   €49.642 and 1,41 respectively
d.   €51.612 and 1,41 respectively

Answer: d

$$NPV = -125.000 + 6.000/1,08^2 + 10.000/(0,08-0,03)/1,08^2 = 51.611,8$$
$$PI = PV/I = (51.611,8+125.000) / 125.000 = 1,41$$

5.
Assume a perfect capital market. The management of a company needs to decide between the purchase of one of three machines. The machines have the same lifespan and capacity and deliver the same product. The performance of the machines is also identical. The lifetime of each of the machines is four years. The purchase price of machine A is equal to that of machine B. The price of machine C is €2.500 higher than that of A and therefore also than that of B. Comparing the cash flows realized with these investments, it also appears that machine C will require €1.450 less in maintenance costs on an annual basis than machines A and B. The maintenance costs are paid at the end of each year (at t = 1, t = 2, t = 3 and at t = 4) to an external company that maintains the machines. We also know that the residual value of machine A is €2.000, that of B €3.000 and that of C €0. The discount rate is 5,00%. Ignore taxes. Management uses the net present value method in making investment decisions.

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

a.   Management prefers to purchase machine A.
b.   Management prefers to purchase machine B.
c.   Management prefers to purchase machine C.
d.   Management is indifferent between the purchase of machine A and C.

Answer: c

r =	5%				
	0	**1**	**2**	**3**	**4**
A					€ 2.000,00
Total	**€ 1.645,40**				€ 1.645,40
	0	**1**	**2**	**3**	**4**
B					€ 3.000,00
Total	**€ 2.468,11**				€ 2.468,11
	0	**1**	**2**	**3**	**4**
C	€ -2.500,00	€ 1.450,00	€ 1.450,00	€ 1.450,00	€ 1.450,00
	€ -2.500,00	€ 1.380,95	€ 1.315,19	€ 1.252,56	€ 1.192,92
Total	**€ 2.641,63**				

The present value of the savings on maintenance (€5.141,63) is greater than the difference between the purchase price of machine C (€2.500) and that of A and B. The difference is €2.641,63. The present value of the residual value of machines A and B (that for C is nil) is lower than €2.641,63. The preference is therefore for machine C.

6.
The following is known about the Bidon company:

- the market value of the interest-bearing debt is €40 million;
- the book value of shareholders' equity is €50 million;
- the market-to-book ratio of shareholders' equity is 1,2;
- the book value of the accounts receivable is €6 million;
- the book value of the accounts payable is €5 million
- the market value of the inventories is €8 million;
- the size of the amount of cash is €15 million.

Question: The enterprise value of company Bidon is closest to:

a.   € 60 million
b.   € 75 million
c.   € 85 million
d.   €100 million

Answer: c

Enterprise value = market value equity + market value interest bearing debt – cash = €50 million × 1,2 + €40 million - €15 million = €85 million

7.

Assume an efficient capital market. Both bond A and B are bullets with a nominal value of €1.000 and have no default risk. The coupon of bond A is 6,00%. Bond B is a so-called 'zero coupon bond' (the coupon of this bond is 0%). The maturity of both bonds A and B is 5 years. Furthermore, it is given that $r_1 = 0,5\%$ and that the term structure of interest rates is increasing.

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

a.   The yield to maturity of bond A is higher than that of bond B.
b.   The yield to maturity of bond A is lower than that of bond B.
c.   The price of bond A is equal to the price of bond B.
d.   The price of bond A is less than that of B.

Answer: b

The yield of A is determined by r_1, r_2, r_3, r_4 and r_5 because we know that:
$P_A = CF_1/(1+r_1) + CF_2/(1+r_2)^2 + CF_3/(1+r_3)^3 + CF_4/(1+r_4)^4 + CF_5/(1+r_5)^5$
$P_A = CF_1/(1+y) + CF_2/(1+y)^2 + CF_3/(1+y)^3 + CF_4/(1+y)^4 + CF_5/(1+y)^5$

The yield of B is equal to r_5 because we know that:
$P_B = CF_5/(1+r_5)^5 = CF_5/(1+y)^5$

Since the term structure of interest rates is increasing, yield A < yield B.
The price of A > price of B, because the coupon of A > coupon of B.

8.

Assume an efficient capital market. Consider four default risk-free bonds in this world. The nominal value of each of the bonds is €1.000. The following is known about these bonds:

Bond	Maturity	Coupon	Price	Yield
A	2 years	4,00%	€ 1.029,13	2,49%
B	3 years	5,00%	€ 1.043,65	?
C	3 years	0,00%	€ 901,94	3,50%
D	4 years	6,00%	€ 1.076,14	?

Furthermore, the 1-year spot rate (r_1) is 2,00%, the 1-year forward rate for year 2 ($_1f_2$) is 3,00% and the 4-year spot rate (r_4) is 4,00%.

Question: The 3-year spot rate (r_3) is closest to

a. 2,7%
b. 2,9%
c. 3,1%
d. 3,5%

Answer: d

$P_C = 901,94 = 1.000 / (1+r_3)^3 = 1.000 / (1+y)^3 \rightarrow y = r_3 = 3,5\%$.

or

$P_D = 60/(1 + r_1) + 60 /(1 + r_2)^2 + 60/(1 + r_3)^3 + 1.060/(1 + r_4)^4 \rightarrow$
$60/(1 + r_3)^3 = P_D - 60/(1+r_1) - 60 /(1+r_2)^2 - 1.060/(1+r_4)^4 \rightarrow$
$(1 + r_3)^3 = 60 / [P_D - 60/(1+r_1) - 60 /(1+r_2)^2 - 1.060/(1+r_4)^4] \rightarrow$
$(1 + r_3) = [60 / [P_D - 60/(1+r_1) - 60 /(1+r_1)(1+_1f_2) - 1.060/(1+r_4)^4]]^{1/3} \rightarrow$
$(1 + r_3) = [60 / [1.076,14 - 60/(1,02) - 60 /(1,02)(1,03) - 1.060/(1,04)^4]]^{1/3} = 1,035$

9.

Assume a perfect asset capital market. The following data is given about company A:

	A
Price per share at t = 0	€200,00
Dividend pay-out ratio	40%
Earnings per share at t = 1 (EPS$_1$)	€20,00
Annual growth rate EPS	?

The applicable discount rate is 6,0%. For Company A, both the payout ratio and the growth rate of the earnings per share remain constant. Company A is fully equity financed.

Question: The growth rate of the earnings per share of company A is closest to

a.   2%
b.   3%
c.   4%
d.   5%

Answer: a
$P_0 = 200 = \text{div}_1 / (r\text{-}g) = (0,4 \times 20)/(0,06\text{-}g) \rightarrow g = 2,0\%$

10.

Assume a world that satisfies the assumptions of portfolio theory. Short selling is allowed. In this world, only the two securities A and B are traded. The following is known about these securities:

	A	B
Expected return [E(R)]	12,0%	20,0%
Variance of the return [σ^2(R)]	0,0625	0,09

The correlation coefficient between the returns of A and B is -0,20. MRP stands for minimum risk portfolio.

Question: The expected return of the MRP is closest to

a. 13,8%
b. 14,2%
c. 15,4%
d. 16,2%

Antwoord: c

$$x_A^* = \frac{\sigma_B^2 - \sigma_A \sigma_B \rho}{\sigma_A^2 + \sigma_B^2 - 2\sigma_A \sigma_B \rho} = \frac{0,09 - \sqrt{0,0625} \cdot \sqrt{0,09} \cdot -0,20}{0,0625 + 0,09 - 2 \cdot \sqrt{0,0625} \cdot \sqrt{0,09} \cdot -0,20} = 0,575342$$

$x_B = (1 - x_A) = 1 - 0,575342 = 0,424658$

$E(R_{MRP}) = x_A \times E(R_A) + x_B \times E(R_B) = 0,575342 \times 12\% + 0,424658 \times 20\% = 15,4\%$

11.

Assume a world that satisfies the assumptions of the portfolio theory. Short selling is allowed. In this world only two risky securities A and B are traded. In the figure below, the curve through A and B represents the minimum risk frontier of these two securities. Furthermore, $\sigma(R_A) = \sigma(R_B)$. It is possible to borrow and lend against the risk-free rate F.
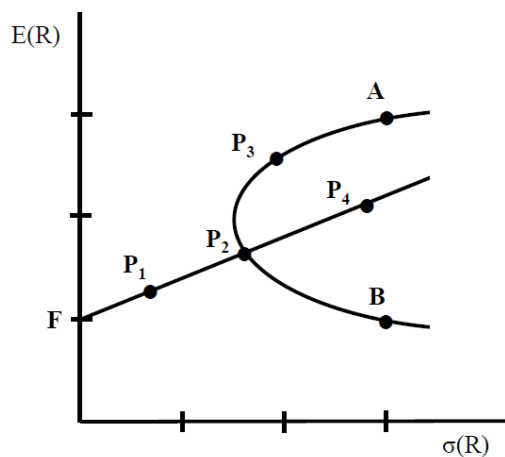
Question: Which of the following statements is **false**?

a. Portfolio P_1 can be formed by going long in both security A and B and F.
b. Portfolio P_2 can be formed by going long in both security A and B.
c. For Portfolio P_3, the long position in A is greater than the long position in B.
d. Portfolio P_4 can be formed by going short in A and long in B.

Answer: d

Portfolio 4 can be formed by going short in F and going long in both A and B.

12.

Assume a world that meets the assumptions of the CAPM. In this world, in addition to risk-free security F with a 2,00% return, only the three risk-bearing securities A, B and C are traded. The following is known about these securities:

Security	A	B	C
E(R)	6,00%	12,00%	15,00%
Number of outstanding shares	50.000	10.000	20.000
Price per share at t = 0	€20	€40	€10

Investor X, operating optimally in this world, has a total capital of €100.000. Investor X borrows €60.000 and goes long in market portfolio M for €160.000.

Question: The number of shares A in the optimal portfolio of X is closest to

a. 4.500
b. 4.750
c. 5.000
d. 5.250

Answer: c

The market capitalization of M is:
50.000 × €20 + 10.000 × €40 + 20.000 × €10 = €1.600.000
If X goes long for €160.000 in M, this means that X buys 62.5% of A shares. After all, the market value of A / market value of M is 62,5% (= €1.000.000 / €1.600.000). The number of A shares that investor x holds in portfolio is then 0.625 × €160.000 / €20 = 5.000

13.

Assume a world that meets the assumptions of the CAPM. The risk-free interest rate is 2,00%. The following is known about portfolio A, B and market portfolio M:

Portfolio	A	B	M
E(R)	?	?	12,00%
Market value	€10 million	€15 million	€200 million
σ(R)	5,00%	10,00%	20,00%
$\rho_{(Ri,RM)}$	0,50	1,00	1,00

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

a.   The expected return of portfolio A is 3,25% and of portfolio B it is 7,00%.
b.   The expected return of portfolio A is 4,50% and of portfolio B it is 7,00%.
c.   The expected return of portfolio A is 3,25% and of portfolio B it is 10,00%.
d.   The expected return of portfolio A is 4,50% and of portfolio B it is 10,00%.

Answer: a

For A applies:
Beta = $\rho_{(Ri,RM)} \times \sigma(R_A) / \sigma(R_M)$ = 0,5 × 5% / 20% = 0,125
According to SML:
E(Ri) = Rf + beta$_i$ ×(E(R$_M$)-R$_F$) = 2% + 0,125 × (12%-2%) = 3,25%

According to CML:
E(Rp) = Rf + σ(Rp) ×(E(R$_M$)-R$_F$)/ σ(R$_M$) = 2% + σ(Rp) × (12%-2%)//0,2
B is efficient, since $\rho_{(Ri,RM)}$ is 1,00. Efficient portfolios are on the CML. For B applies:
E(Rp) = 2% + 0,1 × (12%-2%)/0,2 = 7,00%

NB For B the following applies as well:
Beta = $\rho_{(Ri,RM)} \times \sigma(R_A) / \sigma(R_M)$ = 1 × 10% / 20% = 0,5
According to SML:
E(Ri) = Rf + beta$_i$ ×(E(R$_M$)-R$_F$) = 2% + 0,5 × (12%-2%) = 7,00%

14.
Assume a perfect capital market. Company ADJEN N.V. has two different divisions. One of the divisions deals with payment traffic between consumers and web shops. For this division (division PAYMENT SERVICES) the management of ADJEN N.V. wants to determine the cost of capital using comparable listed company WINECARD N.V.. WINECARD is a company engaged in the same type of activities as ADJEN's division PAYMENT SERVICES. ADJEN is fully financed with equity. WINECARD, unlike AJDEN, is funded by both equity and debt. The market value of WINECARD's equity is €3bn, the market value of its debt is €2bn. The return required by the lenders (R_D) is 4,0%. The beta of WINECARD's equity is 1,2. The market risk premium (MRP) is 8,00%. The risk-free interest rate is 2,00%.

Question: The asset-beta of the PAYMENT-SERVICES division is closest to:

a. 0,54
b. 0,64
c. 0,72
d. 0,82

Answer: d

Asset beta PAYMENT SERVICES = Asset beta WINECARD.

Beta debt WINECARD
$R_D = Rf + $ beta debt $\times$ MRP $\rightarrow$ beta debt $= (R_D - R_F) / $ MRP $= (4\%-2\%) / 8\% = 0,25$

Asset BETA WINECARD $= D/V \times$ beta debt $+ E/V \times$ beta equity $= 2/5 \times 0,25 + 3/5 \times 1,2 = 0,82$

15.

Suppose a Dutch daily newspaper on 27 January 2021 published the following article.

"Pharmaceutical company PFEISER announced yesterday that its profit for the first quarter of 2021 will be "significantly lower" than expected due to problems with the production of the new vaccine COR21. These problems were already known to the management but were revealed only yesterday. This announcement was met with a negative response from investors at the Amsterdam stock exchange. The share price fell immediately from €18,00 to €16,20, a drop of 10,0%. According to analysts, the decline in the value of equity is a correct reflection of the present value of the expected lost cash flows caused by problems in the production of the new vaccine COR21."

Question: Which of the following statements is the **least debatable**?

a.   The above information is in line with the idea that the capital market is inefficient in the weak form of the efficient market hypothesis.

b.   The above information is in line with the idea that the capital market is efficient in the semi-strong form of the efficient market hypothesis.

c.   The above information is in line with the idea that the capital market is efficient in the strong form of the efficient market hypothesis.

d.   Based on the above information, it appears that private investors were actively buying shares on the day of announcement.

Answer: b

a.   False. No information is provided on whether or not it is efficient in the weak form. So debatable.

b.   True. In a market that is efficient in the semi-strong form, new information is immediately and correctly reflected in the prices. According to the analysts, this is the case.

c.   False. If the market were efficient in the strong form, the information would already have been incorporated into the price earlier. Not at the time of announcement. So debatable.

d.   False. There is no evidence that private investors are buying these shares. So debatable.

16.
Company B wants to acquire company T. The market value of B as a stand-alone entity is
€500 million. The market value of T as a stand-alone entity is €250 million. Company B is
financed with €200 million of debt, company T with €100 million of debt.

Table: Data of enterprises B and T as stand-alone entities

	Company B	Company T
Market value equity	€300 million	€150 million
Market value debt	€200 million	€100 million
Total value	€500 million	€250 million

The acquisition is fully financed through the issue of new B shares. By combining the two
companies, the risk for the lenders of both B and T decreases. As a result, the market value of
B's debt increases from €200 million to €205 million and that of T increases from €100
million to €102 million. There are no synergies.

Question: The market value of B's equity immediately after the acquisition of T is closest to:

a.   €300 million
b.   €436 million
c.   €443 million
d.   €450 million

Answer: c

Balance sheet B after acquisition of T:

Assets B	€500 million	Market value equity	€443 million
Assets T	€250 million	Market value debt	€307 million
Total assets	€750 million	Total value	€750 million

On the following pages is part B: **the open questions**.

Part B: Open questions (18 points)

17. (6 points)
Assume a perfect capital market. In this market, bonds issued by company GameStrop are traded. The nominal value per bond is €1.000, the remaining maturity is 2 years and the coupon is 0%. Given the probability of default, investors assume an expected cash flow at t = 2 of €980,00 per bond. The two-year spot rate (r_2) is 2,00%. At t = 0, the price of a bond GameStrop is €797,19.

Questions:
a. Calculate the yield to maturity of a bond GameStrop. Round off to two decimal places (e.g. 1,23%) and show your calculations. (3 points)

b. Determine the 'risk premium' that investors in bonds GameStrop apply when they valuate these bonds. Round off to two decimal places (e.g. 1,23%) and show your calculations. (3 points)

Answers:
a.
P_0 = promised CF_2 / $(1+y)^2$ = 1.000 / $(1+y)^2$ = 797,19 → y = 12,00%

b.
P_0 = expected CF_2 / $(1+r)^2$ = 980 / $(1+r)^2$ = 797,19 → r = 10,87%
The risk premium = r – r_2 = 10,87% - 2,00% = 8,87%

18. (6 points)

Assume a world that meets the assumptions of the portfolio theory. Short selling is allowed. Assume the existence of a capital market with only the two securities A and B. The following information is given about these securities:

	A	B
E(R)	10%	20%
σ(R)	10%	25%

The correlation coefficient between the returns of A and B is 1,00.

Questions:

a. Calculate the expected return of the portfolio with the lowest risk. Round off to two decimal places (e.g. 1.23%). It is not necessary to show your calculation. (4 points)

b. Determine the risk measured as the standard deviation of the return of a portfolio consisting of a long position of €1.200 in A and a short position of €200 in B. Round off to two decimal places (e.g. 1.23%). It is not necessary to show your calculation. (2 points)

Answers:

a.

Calculation x_A and x_B:

$$x_A{}^* = \frac{\sigma_B^2 - \sigma_A \sigma_B \rho_{A,B}}{\sigma_A^2 + \sigma_B^2 - 2\sigma_A \sigma_B \rho_{A,B}} = \frac{0,25^2 - 0,10 \times 0,25 \times 1,00}{0,1^2 + 0,25^2 - 2 \times 0,10 \times 0,25 \times 1,00} = 1,66667$$

$x_B = 1 - x_A \rightarrow x_B = -0,6666667$

Or:

If rho is 1, then:

$$\sigma_P^2 = (x_A \sigma_A + x_B \sigma_B)^2$$

$$\sigma_P^2 = (x_A \sigma_A + x_B \sigma_B)^2 = 0 \rightarrow x_A \sigma_A + x_B \sigma_B = 0 \rightarrow x_A \sigma_A + (1 - x_A)\sigma_B = 0$$

$$x_A \times 0,1 + (1 - x_A)0,25 = 0 \rightarrow x_A = 1,66667$$

Calculation expected return:

E(R_P) = x_A × E(R_A) + x_B × E(R_B) = 1,66667 × 10% - 0,66667 × 20% = 3,33%

b.

x_A = €1.200 / €1.000 = 1,2

$x_B = 1 - x_A \rightarrow x_B = -0,2$

$$\sigma_P^2 = x_A^2 \sigma_A^2 + 2 x_A x_B \rho_{A,B} \sigma_A \sigma_B + x_B^2 \sigma_B^2 =$$

$$(1,2)^2 \times (0,1)^2 + 2 \times 1,2 \times -0,2 \times 0,10 \times 0,25 \times 1,00 + (-0,2)^2 \times (0,25)^2 = 0,0049$$

$$\sigma_P = 0,0049^{0,5} = 7,00\%$$

19. (6 points)
The subjects of Efficient Market Hypothesis (EMH) and "going short" in securities were discussed during the lectures.

Questions
a. What is meant by "the semi-strong form of the efficient market hypothesis"? (2 points)
b. What is meant by "going short in stocks"? (2 points)
c. Mention and explain one advantage of allowing shareholders to go short in stocks. Relate your answer to the efficient market hypothesis. (2 points)

Answers:
a.
In a market that is efficient in its semi-strong form, all publicly available information is directly and correctly incorporated into market prices.

Alternative:
In a market that is efficient in the semi-strong form, it is not possible to systematically beat the market based on publicly available information.

b.
Shorting shares means borrowing shares from someone, selling them and then buying them back and giving them back later.

c.
Teacher's choice. Several answers are possible.

Example of correct answer:
If shareholders believe that share prices are higher than the real value, they can contribute to a correction of the prices by taking short positions. This improves market efficiency.

END