Question #1 of 38

Question ID: 1572686

An annuity will pay eight annual payments of $100, with the first payment to be received one year from now. If the interest rate is 12% per year, what is the present value of this annuity?

A) $496.76.

B) $1,229.97.

C) $556.38.

Explanation

N = 8; I/Y = 12%; PMT = -$100; FV = 0; CPT → PV = $496.76.

(Module 2.1, LOS 2.a)

Question #2 of 38

Question ID: 1572680

A 15-year zero-coupon German government bond has an annualized yield of –1.5%. Assuming annual compounding, the price of the bond per €100 of principal is *closest* to:

A) €125.

B) €115.

C) €105.

Explanation

N = 15; I/Y = –1.5; FV = 100; PMT = 0; CPT PV = –125.45.

(Module 2.1, LOS 2.a)

Question #3 of 38

Question ID: 1572708

An investor purchases a stock on January 1. The annual dividend payments for a stock investment for the next four years, beginning on December 31, are $50, $75, $100, and $125. Based on the cash flow additivity principle, the present value of this series of cash flows will be equivalent to the present value of a $50 annuity and the present value of what series of cash flows?

A) \$0, \$0, \$125, and \$125.

B) \$75, \$50, \$25, and \$0.

C) \$0, \$25, \$50, and \$75.

Explanation

The cash flow additivity principle states that the PV of any stream of cash flows is equal to the sum of the PVs of all of the cash flows. The cash flows are \$50, \$75, \$100, and \$125. So, if one stream of cash flows is equal to \$50 each year, subtract \$50 from each original cash flow to get the second stream of cash flows.

The PV of 50, 75, 100, and 125 = PV of 50, 50, 50, and 50 + PV of 0, 25, 50, and 75.

The order matters, as the PV will be different (and higher) if the higher cash flows come before the lower ones.

(Module 2.2, LOS 2.c)

Question #4 of 38

Question ID: 1572689

Wortel Industries has preferred stock outstanding that paying an annual dividend of \$3.75 per share. If an investor wants to earn a rate of return of 8.5%, how much should he be willing to pay for a share of Wortel preferred stock?

A) \$31.88.

B) \$44.12.

C) \$42.10.

Explanation

To calculate the price, we need to discount the future dividend stream at the investor's required return.

The stream of dividends is a perpetuity (a fixed dividend each year forever).

Given the PV of a perpetuity = cash flow / discount rate

Then price = \$3.75 / 0.085 = \$44.12

(Module 2.1, LOS 2.a)

Question #5 of 38

Question ID: 1572677

A bond pays annual coupon interest of £40 and returns its face value of £1,000 in five years. The bond's yield to maturity is 4.5%. Its price today is *closest* to:

A) £946.

B) £978.

C) £957.

Explanation

N = 5; I/Y = 4.5; PMT = 40; FV = 1,000; CPT PV = –978.05.

(Module 2.1, LOS 2.a)

Question #6 of 38

Question ID: 1572690

An investor purchases a 10-year, $1,000 par value bond that pays annual coupons of $100. If the market rate of interest is 12%, what is the current market value of the bond?

A) $950.

B) $887.

C) $1,124.

Explanation

Note that bond problems are just mixed annuity problems. You can solve bond problems directly with your financial calculator using all five of the main TVM keys at once. For bond-types of problems the bond's price (PV) will be negative, while the coupon payment (PMT) and par value (FV) will be positive. N = 10; I/Y = 12; FV = 1,000; PMT = 100; CPT → PV = –886.99.

(Module 2.1, LOS 2.a)

Question #7 of 38

Question ID: 1572698

Assuming a constant rate of growth in dividends, we can estimate an equity share's:

A) dividend yield as the sum of its required rate of return and its growth rate.

B) growth rate as the sum of its dividend yield and its required rate of return.

C) required rate of return as the sum of its dividend yield and growth rate.

Explanation

Starting with the Gordon growth model, we can solve for the estimated required rate of return, constant growth rate, or dividend yield as follows:

$$k_e = \frac{D_1}{V_0} + g_c$$

$$g_c = k_e - \frac{D_1}{V_0}$$

$$\frac{D_1}{V_0} = k_e - g_c$$

(Module 2.2, LOS 2.b)

Question #8 of 38

Question ID: 1572682

A financial advisor recommends to her client that he buy a 6-year, $1,000 face value bond that pays annual interest of 5%. The yield to maturity is 4.5%, and the client intends to hold the bond as an investment until it matures. The value of the bond today is *closest* to:

A) $1,000.

B) $975.

C) $1,025.

Explanation

With a fixed-coupon, annual-pay bond, the annual interest payment and the principal payment are discounted at the yield to maturity. The calculator solution is to solve for present value while setting the number of periods (N) to 6, the annual payment (PMT) to 50 (which is 1,000 × 5%), the future value (FV) to 1,000, and the yield (I/Y) to 4.5%:

$$\frac{50}{1.045} + \frac{50}{1.045^2} + \ldots + \frac{1{,}050}{1.045^6} = 1{,}025.79$$

This can also be answered using the calculator: N = 6; I/Y = 4.5; PMT = 50; FV = 1,000. CPT PV = –1,025.79.

It is also worth noting that because the yield to maturity (4.5%) is below the coupon rate (5%), the bond's current price must be above the par value of $1,000. $975 would only be possible if the yield was above the coupon rate.

(Module 2.1, LOS 2.a)

Question #9 of 38

Question ID: 1572695

An investor makes 48 monthly payments of $500 each beginning today into an account that will have a value of $29,000 at the end of four years. The stated annual interest rate is *closest to*:

A) 10.00%.

B) 9.00%.

C) 9.50%.

Explanation

Because this is an annuity due (payments at the start of each period) the calculator must first be set to BGN mode.

N = 48; PMT = 500; FV = –29,000; PV = 0; CPT I/Y = 0.7532

This percentage is a monthly rate because the time periods were entered as 48 months. It must be converted to a stated annual percentage rate (APR) by multiplying by the number of compounding periods per year: 0.7532 × 12 = 9.04%.

(Module 2.2, LOS 2.b)

Question #10 of 38

Question ID: 1572678

A perpetual bond with a face value of $100,000 pays annual interest of 5%. The bond is quoted at a yield of 7%. The bond's price is *closest* to:

A) $140,000.

B) $71,500.

C) $98,100.

Explanation

$$\frac{\$100{,}000(0.05)}{0.07} = \$71,428.57.$$

(Module 2.1, LOS 2.a)

Question #11 of 38

Question ID: 1572681

An investor pays \$726.27 for a zero-coupon bond with a face value of \$1,000 and maturing in 10 years. Bonds with similar risk profiles and with similar terms yield 3.00%. The yield to maturity for this bond is *closest* to:

A) 3.25%.

B) 2.75%.

C) 3.00%.

Explanation

A zero-coupon bond pays no interest, but it is most often purchased at a price heavily discounted from par value. The equation that shows the relationship between the present value (the purchase price), the future value, time, and yield to maturity is shown as follows:

$$\$726.27 = \frac{\$1{,}000}{(1+\mathrm{r})^{10}}$$

$$1+\mathrm{r} = \sqrt[10]{\frac{1{,}000}{726.27}}$$

$$\mathrm{r} = 1.0325 - 1 = 0.0325,\ \text{or } 3.25$$

This can also be answered using the calculator: N = 10; PV = –726.27; PMT = 0; FV = 1,000. CPT I/Y = 3.25.

2.75% is the yield to maturity if the present value is incorrectly input as \$762.27 instead of \$726.27. The yield on similar bonds does not reflect the yield on a specific bond.

(Module 2.1, LOS 2.a)

Question #12 of 38

Question ID: 1572703

An analyst is using the constant growth dividend discount model (DDM) to evaluate XYZ stock. The stock is currently trading at \$20 per share and recently paid an annual dividend of \$1.50. Assuming a constant growth rate of 4.5%, the implied required rate of return on the stock is *closest* to:

A) 12.00%.

B) 12.34%.

C) 11.68%.

Explanation

The Gordon growth model, also known as the DDM, takes the next period's dividend and divides it by the difference between the required return and the growth rate. The formula can be algebraically manipulated to isolate the required rate of return. The calculation to determine the required rate of return is shown:

$$k_e = \frac{D_1}{V_0} + g_c = \frac{1.50(1.045)}{20} + 0.045 = 0.1234\text{, or } 12.34$$

The 11.68% answer option is the output if the current dividend is discounted by the growth rate rather than increased by the growth rate to get to the next period's dividend.

The 12.00% answer option is the output if the current dividend is used in the calculation without adjusting for the growth rate.

(Module 2.2, LOS 2.b)

Question #13 of 38

Question ID: 1572700

An investor spends $365,000 purchasing zero-coupon bonds with a total face value of $500,000 and maturing in 10 years. For the annualized rate of return to be above 3.20%, the bond's price will have to be:

A) equivalent to $365,000.

B) lower than $365,000.

C) higher than $365,000.

Explanation

With a future value of $500,000, a present value of $365,000, and a maturity of 10 years, the annualized rate of return is calculated as shown:

$$\frac{\$500{,}000}{(1+r)^{10}} = \$365{,}000$$

$$(1+r)^{10} = \frac{\$500{,}000}{\$365{,}000} = 1.36986$$

$$r = 1.36986^{1/10} - 1 = 0.0320$$

On the calculator, N = 10; PV = –365,000; PMT = 0; FV = 500,000; CPT I/Y = 3.2.

Because the annualized return is 3.20% and the question asks about what the bond's price must be to be above 3.20%, the price of the bond must be below the purchase price of $365,000. The relationship between the price and rate of return is inverse; for the rate of return to be above 3.20%, the price must fall.

(Module 2.2, LOS 2.b)

Question #14 of 38

Question ID: 1572683

A bond with a 10-year maturity has a face value of $10,000 and pays annual interest of $600. The bond is issued at a price of $9,500. The bond's yield to maturity will be:

A) greater than 6%.

B) equal to 6%.

C) less than 6%.

Explanation

No calculations are needed to answer this question. This bond was issued at a price of $9,500, which is below face value of $10,000. The bond is considered a discount bond, and this results from a situation where the bond's coupon rate is below the yield to maturity. With annual interest of $600 on a face value of $10,000, the coupon rate is equal to 6% (600 / 10,000). The yield to maturity must be greater than 6% for the bond to be issued at a discounted price.

(Module 2.1, LOS 2.a)

Question #15 of 38

Question ID: 1572696

A pure discount instrument with a face value of ¥500 million matures nine years from today and has a current price of ¥350 million. The instrument's annualized yield is *closest* to:

A) 3.3%.

B) 4.7%.

C) 4.0%.

Explanation

$$(1+\mathrm{r})^9 = \frac{500}{350}$$

r = $\left(\frac{500}{350}\right)^{\frac{1}{9}} - 1 = 4.04\%.$

(Module 2.2, LOS 2.b)

Question #16 of 38

Question ID: 1572702

An investor looks at her monthly brokerage statement and notices that the yield to maturity on her 5-year corporate bond with a 4% annual coupon rate has gone from 4.2% last month to 3.8% this month. The statement will reflect a bond price that, over the last month, has:

A) decreased.

B) remained flat.

C) increased.

Explanation

Bond prices and yields move in opposite directions, such that if the yield has dropped from 4.2% to 3.8%, it must be a case that the price of the bond has increased. A decrease in price would align with an increase in yield to maturity. If the price had remained flat, the yield would be unchanged.

(Module 2.2, LOS 2.b)

Question #17 of 38

Question ID: 1572693

Given a 5% discount rate, the present value of $500 to be received three years from today is:

A) $400.

B) $432.

C) $578.

Explanation

N = 3; I/Y = 5; FV = 500; PMT = 0; CPT → PV = 431.92.

or: $500/1.05^3 = 431.92$.

(Module 2.1, LOS 2.a)

Question #18 of 38

Question ID: 1572710

An investor is deciding whether to buy a 1-year bond two years in a row or lock in the rate on a 2-year bond today. The 1-year spot interest rate is 5.25%, and the 2-year spot interest rate is 6.50%. Which of the following statements is *most accurate* regarding implied forward rates and the investor's options?

A) The expected rate on a 1-year bond one year from today is equal to 7.76%.

B) The forward rate will be between 5.25% and 6.50%.

C) The investor is better off locking in the 2-year rate at 6.50%.

Explanation

Implied forward rates can be derived based on observable spot rates in the fixed income market. The result is that the implied 1-year forward rate one year in the future can be derived based on this formula:

$$\frac{(1{+}\mathrm{S}_2)^2}{(1{+}\mathrm{S}_1)} = (1 + 1y1y)$$

$$\frac{(1.065)^2}{(1.0525)} - 1 = 0.0776$$

The forward rate (1y1y) is equal to 7.76%.

The forward rate will be higher than both spot rates, which means it cannot be between 5.25% and 6.50%. The investor should be indifferent between the 2-year bond paying 6.50% and 1-year bonds at 5.25% and 7.76%.

(Module 2.2, LOS 2.c)

Question #19 of 38

Question ID: 1572707

Assume that one- and two-year risk-free rates are 1.80% and 2.50%, respectively. Using the cash flow additivity principle, the one-year reinvestment rate, one year from now is *closest* to:

A) 2.8%.

B) 3.2%.

C) 3.5%.

Explanation

$$\mathrm{F}_{1,1} = \frac{(1{+}\mathrm{r}_2)^2}{(1{+}\mathrm{r}_1)^1} - 1 = \frac{1.025^2}{1.018^1} - 1 = 3.2\%$$

(Module 2.2, LOS 2.c)

Question #20 of 38

Question ID: 1572684

An equity investor has a required return of 7% and purchases preferred stock with a $50 per share par value and an annual dividend of $3.20. The value of the preferred stock is *closest* to:

A) $46.

B) $50.

C) $43.

Explanation

The value of preferred stock, based on the assumption that the annual dividend will be paid in perpetuity, is equal to:

The correct answer is 45.71, which is closest to $46 per share.

$$\frac{D_P}{k_P} = \frac{3.20}{0.07} = 45.71$$

(Module 2.1, LOS 2.a)

Question #21 of 38

Question ID: 1572679

A stock is expected to pay a dividend next year of $2.40. An analyst expects the dividend to grow at a constant annual rate of 4% and believes investors' required rate of return on the stock is 7%. The analyst will estimate a value for this stock that is *closest* to:

A) $85.60.

B) $80.00.

C) $83.20.

Explanation

Applying the Gordon growth model, $\frac{\$2.40}{0.07-0.04} = \$80.$

(Module 2.1, LOS 2.a)

Question #22 of 38

Question ID: 1572691

Given investors require an annual return of 12.5%, a perpetual bond (i.e., a bond with no maturity/due date) that pays $87.50 a year in interest should be valued at:

A) $70.

B) $700.

C) $1,093.

Explanation

87.50 ÷ 0.125 = $700.

(Module 2.1, LOS 2.a)

Question #23 of 38

Question ID: 1572685

To determine whether the current price of a common stock is aligned with its intrinsic value, an analyst wants to use the Gordon growth model. To appropriately apply the model, the analyst will need to estimate:

A) the dividend to be received next year.

B) a fluctuating growth rate assigned to dividends.

C) a growth rate that is above the required return.

Explanation

The Gordon growth model, also known as the constant growth dividend discount model (DDM), takes the next period's dividend and divides it by the difference between the required return and the growth rate. The growth rate is assumed to be constant, and it must be below the required return—or else the denominator of the calculation will be negative, making it invalid.

(Module 2.1, LOS 2.a)

Question #24 of 38

Question ID: 1572674

Bill Jones is creating a charitable trust to provide six annual payments of $20,000 each, beginning next year. How much must Jones set aside now at 10% interest compounded annually to meet the required disbursements?

A) $154,312.20.

B) $87,105.21.

C) $95,815.74.

Explanation

N = 6, PMT = -$20,000, I/Y = 10%, FV = 0, Compute PV → $87,105.21.

(Module 2.1, LOS 2.a)

Question #25 of 38

Question ID: 1572705

Given the following cash flow stream:

End of Year	Annual Cash Flow
1	$4,000
2	$2,000
3	-0-
4	-$1,000

Using a 10% discount rate, the present value of this cash flow stream is:

A) $3,636.00.

B) $4,606.00.

C) $3,415.00.

Explanation

PV(1): N = 1; I/Y = 10; FV = -4,000; PMT = 0; CPT → PV = 3,636

PV(2): N = 2; I/Y = 10; FV = -2,000; PMT = 0; CPT → PV = 1,653

PV(3): 0

PV(4): N = 4; I/Y = 10; FV = 1,000; PMT = 0; CPT → PV = -683

Total PV = 3,636 + 1,653 + 0 – 683 = 4,606

(Module 2.2, LOS 2.c)

Question #26 of 38

Question ID: 1572711

Assuming the 1-year riskless interest rates on the U.S. dollar and British pound are 3.5% and 4.0% respectively, the forward exchange rate between the two currencies will be different than the spot rate by approximately:

A) 0.50%.

B) 3.75%.

C) 7.50%.

Explanation

The percentage difference between forward and spot exchange rates is approximately equal to the difference between the interest rates in the two countries. Although there is a more refined calculation, the difference between the forward and spot rates will be approximately equal to 4.0% – 3.5% = 0.50%.

3.75% is just the average of the two rates, and 7.50% adds them together instead of taking the difference.

(Module 2.2, LOS 2.c)

Question #27 of 38

Question ID: 1572688

Compute the present value of a perpetuity with $100 payments beginning four years from now. Assume the appropriate annual interest rate is 10%.

A) $683.

B) $751.

C) $1,000.

Explanation

Compute the present value of the perpetuity at (t = 3). Recall, the present value of a perpetuity or annuity is valued one period before the first payment. So, the present value at t = 3 is 100 / 0.10 = 1,000. Now it is necessary to discount this lump sum to t = 0. Therefore, present value at t = 0 is 1,000 / $(1.10)^3$ = 751.

(Module 2.1, LOS 2.a)

Question #28 of 38

Question ID: 1572701

A 5-year, 8% coupon bond with a par value of $1,000 pays interest annually. The price is $942.50, and the yield to maturity is 9.50%. If the price of the bond moves to $963.75, the yield to maturity will be closest to:

A) 10.07%.

B) 8.55%.

C) 8.93%.

Explanation

Because the price of the bond increases, the yield to maturity will fall from its current level. The current level is 9.50%, which means the yield cannot be 10.07%. The calculation for the yield can be derived using a financial calculator:

$$\begin{aligned} PV &= -963.75 \\ FV &= 1{,}000.00 \\ N &= 5 \text{ years} \\ PMT &= 80 \ \ (8\% \text{ of par}) \\ \text{Solve for } I/Y &= 8.93. \end{aligned}$$

(Module 2.2, LOS 2.b)

Question #29 of 38

Question ID: 1572694

A share of George Co. preferred stock is selling for $65. It pays a dividend of $4.50 per year and has a perpetual life. The rate of return it is offering its investors is *closest* to:

A) 6.9%. ✓

B) 4.5%. ✗

C) 14.4%. ✗

Explanation

4.5 / 65 = 0.0692, or 6.92%.

(Module 2.1, LOS 2.a)

Question #30 of 38

Question ID: 1572706

An investor with USD1,000,000 is undecided between two mutually exclusive opportunities with the following cash flows:

	Time 0	Time 1	Time 2	Time 3
Opportunity 1	–1,000,000	500,000	500,000	500,000
Opportunity 2	–1,000,000	400,000	500,000	600,000

The investor's required return is 11% per year. Which opportunity should the investor choose?

A) The investor should be indifferent between the two opportunities.

B) The investor should choose Opportunity 1.

C) The investor should choose Opportunity 2.

Explanation

Although this problem may be solved by calculating the individual NPVs of each opportunity (Opportunity 1: 221.86 and Opportunity 2: 204.89), another approach would be to use the cash flow additivity principle as follows:

	Time 1	Time 2	Time 3
Opportunity 1	500,000	500,000	500,000
Opportunity 2	400,000	500,000	600,000
Cash flow difference	+100,000	0	–100,000

Because the present value of the cash flow difference arising at Time 1 (in favor of Opportunity 1) must exceed the present value of the negative cash flow difference arising at Time 3 (in favor of Opportunity 2) at any positive discount rate, Opportunity 1 is preferred.

(Module 2.2, LOS 2.c)

Question #31 of 38

Question ID: 1572675

A pure discount instrument with a face value of ¥100 million matures 12 years from today. If its yield to maturity is 3%, its price today is *closest* to:

A) ¥71 million. ✗

B) ¥70 million. ✓

C) ¥72 million. ✗

Explanation

¥100,000,000(1.03)$^{-12}$ = ¥70,137,988.

(Module 2.1, LOS 2.a)

Question #32 of 38

Question ID: 1572704

Using a constant growth dividend discount model (DDM), an analyst assumes a required return on equity of 9.75%. The current stock price is $30 per share, and the next period's dividend is $2.40 per share. The constant growth rate implied in the model is *closest* to:

A) 1.75%. ✓

B) 1.89%. ✗

C) 1.83%. ✗

Explanation

The Gordon growth model, also known as the DDM, takes the next period's dividend and divides it by the difference between the required return and the growth rate. The formula can be algebraically manipulated to isolate the implied growth rate. The calculation to determine the growth rate is shown:

$$g_c = k_e - \frac{D_1}{V_0} = 0.0975 - \frac{2.40}{30} = 0.0975 - 0.08 = 0.0175,\ \text{or } 1.75$$

The 1.83% answer option takes the correct answer of 1.75% and adds the dividend yield of 8%: 1.75% + 0.08% = 1.83%. The 1.89% answer option takes the correct answer of 1.75% and grows it by multiplying it by the dividend yield of 8%: 1.75% × (1.08) = 1.89%.

(Module 2.2, LOS 2.b)

Question #33 of 38

Question ID: 1572692

An investment product promises to pay a lump sum of $25,458 at the end of 9 years. If an investor feels this investment should produce a rate of return of 14%, compounded annually, the present value is *closest* to:

A) $9,426.00.

B) $7,618.00.

C) $7,829.00.

Explanation

$25,458 / 1.14^9 = 7,828.54$

Alternatively, N = 9; I/Y = 14; FV = -25,458; PMT = 0; CPT → PV = $7,828.54.

(Module 2.1, LOS 2.a)

Question #34 of 38

Question ID: 1572709

An investor is choosing between two possible investments. Both have identical future cash flows in all situations, but the investor notices a slight discrepancy in price between the two. What action will this investor take based on the no-arbitrage principle?

A) Wait for the prices to further diverge, then sell the higher-priced investment.

B) Do nothing, as there cannot be a price divergence based on the rule.

C) Act quickly by buying the lower-priced investment, as the prices will quickly converge.

Explanation

The no-arbitrage principle (law of one price) states that the price for an investment will be the same if two sets of future cash flows are identical under all conditions. Although there should not be a discrepancy in theory, there may be one for a short time period. If there is a slight price discrepancy between these investments, it will not last long, so the investor should act quickly and buy the lower-priced investment. The prices would not further diverge.

(Module 2.2, LOS 2.c)

Question #35 of 38

Question ID: 1572699

Abeta's stock is trading at $47. Abeta just paid a dividend of $1.50, and markets assume a constant growth rate in dividends of 4%. Abeta's required return on equity is *closest* to:

A) 8.1%.

B) 6.5%.

C) 7.3%.

Explanation

To calculate the implied cost of equity, we rearrange the constant growth formula as follows:

$$\mathrm{r} = \frac{D_0 \times (1+g)}{P_0} + \mathrm{g} = \frac{1.50 \times 1.04}{47.00} + 0.04 = 7.32\%$$

(Module 2.2, LOS 2.b)

Question #36 of 38

Question ID: 1572697

A bond pays annual coupon interest of £60 and returns its face value of £1,000 in seven years. The bond's price today is £1,045. Its yield to maturity is *closest* to:

A) 5.2%.

B) 6.8%.

C) 6.0%.

Explanation

N = 7; PMT = 60; FV = 1,000; PV = –1,045; CPT I/Y = 5.2162.

(Module 2.2, LOS 2.b)

Question #37 of 38

Question ID: 1572687

A loan of $15,000 is to be paid off in monthly payments over 5 years at 12% annual interest. What is the amount of each payment?

A) $334.

B) $1,802.

C) $4,161.

Explanation

I = 12 / 12 = 1; N = 5 × 12 = 60; PV = 15,000; CPT → PMT = 333.67.

(Module 2.1, LOS 2.a)

Question #38 of 38

Question ID: 1572676

A pure discount instrument with a face value of €1 million matures eight years from today. If its yield to maturity is –1.5%, its price today is *closest* to:

A) €1.13 million.

B) €0.98 million.

C) €0.89 million.

Explanation

Given these three answer choices, you can choose the correct answer without performing the calculation. With a negative yield, the price of a single future cash flow must be greater than the amount of the cash flow. In this case, €1,000,000(1 0.015)$^{-8}$ = €1,128,522.

(Module 2.1, LOS 2.a)