

Mock Test Questions for NISM Series XXI-B: Portfolio Managers Certification Examination

1. An index comprises of three stocks, X,Y,Z, whose annual revenues are in the ratio of 1:2:3, respectively. What would be the percentage change in the factor weighted index between two points of time, if the prices of these three stocks move from Rs. 200, Rs. 400, Rs. 800 to Rs. 400, Rs. 600, Rs. 900, respectively?
- a) 39.58%
 - b) 35.98%
 - c) 35.89%
 - d) 38.59%

Answer: a) 39.58

Explanation: $(100\% * 1/6) + (50\% * 2/6) + (12.5\% * 3/6) = 39.58\%$

2. A portfolio manager would like to retain atleast 10% of the investible funds in the form of cash. Competitive pressures force him to target portfolio return of 18%. He is confident of generating a return of 19% on the portfolio, and the cash would generate a maximum of 3% return. With Rs.100 crores of investible funds for management, how much is the liquidity policy dragging down the overall portfolio return from the target portfolio return in rupee terms.
- a) Rs. 0.6 crores
 - b) Rs. 1.6 crores
 - c) Rs.0.06 crores
 - d) Rs.0.16 crores

Answer: a) Rs. 0.6 crores

Explanation: $(0.9*0.19) + (0.1 * 0.03) = 17.4\%$; $(100*0.18) - (100 - 0.174) = 0.6$ crores

3. An investor deposits Rs.200 lakhs today with a fund manager for a period of 5 years and gives a mandate that at any cost there should not be any erosion of this initial wealth by the end of 5 years. If the current risk free rate of return is 8%, what amounts can be invested by the fund manager in the risk free and risky assets, if the organisation, limits the leverage multiplier to a maximum of 2?
- a) Rs.72.22 lakhs and Rs.127.78 lakhs
 - b) Rs.127.78 lakhs and Rs. 72.22 lakhs
 - c) Rs.63.89 lakhs and Rs. 136.11 lakhs
 - d) Rs.136.11 lakhs and Rs. 63.89 lakhs

Answer: a) Rs.72.22 lakhs and Rs.127.78 lakhs

Explanation: The Present Value of Rs.200 lakhs @ 8% for 5 years = $(200/(1.08^5)) = 136.11$. Therefore the manager can invest upto $(200 - 136.11) * 2$ in the risky asset = Rs.127.78 lakhs and the balance Rs.72.22 lakhs in the risk free asset

4. A company is expected to generate EBIT of Rs.200 crores next year. The estimated depreciation expense next year is Rs.50 crores. The company has a planned CAPEX of Rs.100 crores, also requiring Rs.50 crores towards additional working capital. As a policy the company always finances both CAPEX and working capital with a mix of debt and equity in the ratio of 1:1. The company plans to repay Rs.30 crores of its debt next year, pay Rs. 20 crores as interest, and it is in the marginal tax bracket of 30%. What is the estimated FCFE?
- a) Rs.71 crores
 - b) Rs.46 crores
 - c) Rs.101 crores
 - d) Rs.70 crores

Answer: a) Rs.71 crores

Explanation: $(200 - 20) * (1 - 0.3) + 50 - 100 - 50 + (75 - 30) = \text{Rs.71 crores}$

$(\text{EBIT}-\text{Interest}) * (1-\text{tax rate}) + \text{Depreciation} - \text{CAPEX} - \text{Working capital} + (\text{Net borrowings})$

$\text{Capex} = \text{Planned capex} + \text{additional working capital} = (100+50=150)$

$\text{Debt} = 75$ and $\text{Equity} = 75$ (since debt to equity ratio is 1:1)

$\text{Net borrowings} = \text{Debt} - \text{Repayment of debt}$

5. The expected FCFE of a firm for the next year is Rs.71 crores. The current market price of this firm's equity share is hovering around Rs.550. The consensus estimate of growth in cashflows into the foreseeable future is 5%. Analysts who follow the company regularly are of the opinion that this company's market beta would be 1.2. The 10 year Govt Bond Yield is 6% and the Indian markets are expected to generate a market risk premium of 8%. (NOTE: All calculations have to be rounded off to 2 decimal places). What is your opinion about the market valuation of this firm's equity share if you adopt the discounted cashflow model and no other perspective of your own?
- a) Undervalued
 - b) Overvalued
 - c) Correctly Valued
 - d) Can't be estimated

Answer: a) Undervalued

Explanation: $71 / (0.156 - 0.05) = 669.80$; discounting rate = $6 + (1.2 * 8) = 15.6\%$

Discount rate: Risk free rate + Beta*(Market risk premium)

Valuation using discounted cash flow method: $\text{FCFE} / (\text{discounting rate} - \text{growth rate})$

6. A bond with a face value of Rs.1000 is currently sold at Rs.950. The coupon of this bond is 12%, which is paid once in a year, and the balance term to maturity of this bond is 10 years. If it has a callable feature and its first call can be invoked at the end

of 7 years at a premium of 5% on the face value, then what is the Yield to Call of this bond?

- a) 13.62%
- b) 13.2%
- c) 12.28%
- d) 12.49%

Answer: a) 13.62%

Explanation: YIELD (Settlement, Maturity, Coupon Rate, Current Market Price, Call Price, Frequency of Coupon Payment, Day Count Convention)

7. A bond with a face value of Rs.1000 is currently sold at Rs.975. The coupon of this bond is 8%, which is paid twice a year. If the bond is going to be redeemed at the end of 10 years at a premium of 5% on the face value, then what is the Yield to Maturity of this bond?

- a) 8.70%
- b) 8%
- c) 9.02%
- d) 8.72%

Answer: a) 8.70%

Explanation: YIELD (Settlement, Maturity, Coupon Rate, Current Market Price, Redemption Price, Frequency of Coupon Payment, Day Count Convention)

8. A bond with a face value of Rs.1000 is currently sold at Rs.950. The coupon of this bond is 12%, which is paid once a year. If the bond is going to be redeemed at the end of 10 years at a premium of 5% on the face value, then what is the Duration of this bond?

- a) 6.20 years
- b) 5.8 years
- c) 7 years
- d) 8.5 years

Answer: a) 6.20 years

Explanation: Initially using the details, the YTM has to be found out later using this YTM in the Yield variable of the EXCEL function DURATION (Settlement, Maturity, Coupon Rate, Yield, Frequency of Coupon Payment, Day Count Convention)

9. A portfolio manager receives a mandate to manage funds of a trust requiring 14% return per annum. Keeping in view the risk appetite of the trust, the portfolio manager identifies two bonds A and B for investment. They are currently priced at Rs.880 and Rs.1000 respectively. Both bonds have a face value of Rs.1000, have similar number

of years to maturity of 10 years, and are going to be redeemed at 5% premium, but have differing coupon rates of 11%(A) and 15%(B), which are paid once in a year. Which of the bonds was overvalued when the portfolio manager purchased them?

- a) Bond A
- b) Bond B
- c) Both of them
- d) None of them

Answer: a) Bond A

Explanation: Calculate the intrinsic value of the Bonds using PRICE function of EXCEL and then compare with the current market price PRICE (Settlement, Maturity, rate, yield redemption, frequency, [basis])

10. An Educational Institution approaches a PMS provider for managing its Fund of Rs. 50 lakhs. The investment horizon is 10 years. The portfolio manager setups a portfolio of two bonds with a duration of 10 years on 1st January. On 1st January, Bond A was selling at Rs. 750 with a Face Value of Rs.1000, paying 8% coupon once per year and maturing in 25 years. Bond B was selling at Rs. 690 with a Face Value of Rs.1000, paying 5% coupon once a year and maturing in 30 years. If the future 30 years would have a flat yield curve, how many A and B Bonds would have been purchased by the bond manager?

- a) 6287 and 413
- b) 6000 and 500
- c) 6100 and 495
- d) 7200 and 650

Answer: a) 6287 and 413

Explanation: Initially arrive at the yields to maturity given the market prices. Then arrive at the Duration of each bond.

To calculate the weightages of investment in each bond:

If x is the weight of the Bond A then (1-x) is the weight of Bond B. The weighted average duration of the portfolio should be 10. So after calculating duration of bond A and Bond B, form the following equation:

[duration of Bond A multiplied by (x)] + [duration of Bond B multiplied by (1-x)]=10. With this x can be solved. Thereafter, the amount of Rs.50,00,000 will be invested in each bond as per the weightage. After that the number of bonds can be calculated (Amount invested / Price of Bond).

11. An investor stipulates a hurdle rate of 20% p.a. on a Rs.1 crore fund assigned to a portfolio manager with all the discretion given to the PMS. As performance fee, the PMS decided to charge 30% over the hurdle rate, over and above a fixed charge of 1.5% p.a., Brokerage and other expenses of 0.2% and 0.5%, respectively, of the net

AUM invested at the beginning of the year. During the first year, the portfolio earned 35% on the initial fund invested. How much performance fee will be payable to the portfolio manager?

- a) Rs.3,84,000
- b) Rs.39,84,000
- c) Rs.36,00,000
- d) Nil

Answer: a) Rs. 3,84,000

Explanation: $[1 \times (1.35) - \{1 \times (1 + (0.15 + 0.5 + 0.2))\}] - [1 \times (1.20)] \times 0.3 = 3,84,000$

Initial Investment	10000000
Hurdle Rate	20%
Fixed Fee	1.50%
Brokerage	0.50%
Other Expenses	0.20%
Performance Fee	30%
Return on the Portfolio	35%
Portfolio Value with Return	13500000
Less Fixed Fee	150000
Less Brokerage	50000
Less Other Expenses	20000
Pre Performance Fee Value	13280000
Fund Value with Hurdle Rate	12000000
Excess over Client's Hurdle	1280000
Performance Fee to be charged <i>(Excess over Client's hurdle * performance fee)</i>	3,84,000

12. A fund manager is interested to calculate her performance fees for the second year of fund management. She started with a net fund value of Rs.1,28,96,000 and generated a return of 25% for the second year. As per the SEBI guidelines the high water mark fund value has to be Rs.1,32,80,000. The hurdle rate given by the client is 20% and the fund manager negotiated 30% towards performance fees. The fixed charges, brokerage and other expenses are 1.5%, 0.5% and 0.2% respectively. How much performance fees can she charge this year?

- a) NIL
- b) Rs.39,84,000
- c) Rs.48,36,000
- d) Rs.47,50,886.40

Answer: a) NIL

Explanation: $\{[12896000 \times (1.25) - \{1 * (1 + (0.15 + 0.5 + 0.2))\}] - 13280000\} / 13280000 =$
less than 20%

High water mark fund value	1,32,80,000
Net Value of the Portfolio	1,28,96,000
Return on the Portfolio	25%
Portfolio Value with Return	1,61,20,000
Less Fixed Fee	1,93,440
Less Brokerage	64,480
Less Other Expenses	25,792
Pre Performance Fee Value	1,58,36,288
Return over the High Water Mark	19.25%

13. Boom, Normal, and Recession are expected to occur with the probabilities of 55%, 35%, and 10%, in the coming year. In Boom, securities A and B can generate an annual return of 25%, 23%. In Normal, 19%, 17%, and in Recession, 13% and 11% respectively. What should be the proportions in which a fund manager need to invest in A and B to generate an expected return of 20% from the portfolio?

- a) 15% and 85%
- b) 20% and 80%
- c) 50% and 50%
- d) 40% and 60%

Answer: a) 15% and 85%

Explanation: Arrive at ex-ante returns of A and B as 21.7 and 19.7 from the given data. Then assuming weight of A as 'x' and weight of B as (1-x), equate the weighted average return to 20.

14. A fund manager invested 15% and 85% of the fund in stocks A and B respectively. They are expected to generate ex-ante returns of 21.7% and 19.7% for the coming year. The correlation coefficient of returns of the securities is 0.4 and their standard deviations are 4.01% each. What is the risk of the portfolio?

- a) 3.69%
- b) 3.46%
- c) 4.01%
- d) 4.25%

Answer: a) 3.69%

Explanation: Use Markowitz model to arrive at the Portfolio Variance and then take the square root of the same.

15. A fund manager invested 15% and 85% of the fund in stocks A and B respectively. They are expected to generate ex-ante returns of 21.7% and 19.7% for the coming year. The risk of the portfolio is 25%. What is the utility of this portfolio to the investor, and would she pick it up if her risk aversion index is 5 and the risk free rate of return is 6%?
- a) 4.38%, No
 - b) 4.83%, Yes
 - c) 10%, No
 - d) 12.5%, Yes

Answer: a) 4.38%, No

Explanation: Use the portfolio return of 20% and portfolio risk of 25% with the Utility formula, $0.2 - (0.5 * 5 * 0.25 * 0.25)$. If the Utility is greater than risk free rate, one would invest.

16. A fund manager invested 15% and 85% of the fund in stocks A and B respectively. Their market beta is 1.2 and 1.5 respectively. If the expected risk free rate of return is 6% and the relevant market risk premium is 10%. Then what can be the expected rate of return of this portfolio, if the markets are efficient?
- a) 20.55%
 - b) 21%
 - c) 18%
 - d) 20%

Answer: a) 20.55%

Explanation: Use Portfolio beta as a weighted average beta $(0.15 * 1.2) + (0.85 * 1.5) = 1.455$. Then using CAPM approach the expected return is $6\% + (1.455 * 10\%) = 20.55\%$

17. When the expected annual return on a portfolio is 18% and it varies with a standard deviation of 20%. Then what is the 95% VaR of this portfolio, for a 10 days holding period? Assume a 250 days in a year and take 1.645 as the relevant Z value for the calculation of VaR.
- a) -5.83%
 - b) -6.55%
 - c) -7.81%
 - d) -8.53%

Answer: a) -5.83%

Explanation: Daily return $0.18/250 = 0.072\%$; 10 days return = $0.072 * 10 = 0.72\%$; Daily standard deviation = 1.26% ; 10 days standard deviation = $1.26 * \sqrt{10} = 3.9845$; 10 day VaR in percentage terms @ 5% significance level or 95% confidence = $0.72 - (1.645 * 1.26 * \sqrt{10}) = -5.83\%$

18. A PMS manager predicts prices of 30 stocks in a quarter of a normal year, each one coming from a different industry. During the previous one year he was successful in predicting 25,30,28,20 stocks respectively in the four predicting periods. How good is the manager in predicting? What metric would you like to use for the same? (round off to two decimals)

- a) 0.72; Information Coefficient
- b) 0.72; Information Ratio
- c) (-)0.28; Information Coefficient
- d) (-) 0.28 Information Ratio

Answer: a) 0.72; Information Coefficient

Explanation: $IC = [2 * (25+30+28+20)/120] - 1 = 0.72$

Information coefficient= $[2*(Right Prediction/Total Prediction)]-1$

19. A PMS manager predicts prices of 20 stocks in a quarter of a normal year, each one coming from a different industry. During the previous one year he was successful in predicting 15,20,18,10 stocks respectively in the four predicting periods. What is the breadth of this manager and how much would be her Information Ratio? (round off to two decimals)

- a) 8.94 and 5.14
- b) 8.94 and 5.75
- c) 5.14 and 0.575
- d) 5.14 and 5.75

Answer: a) 8.94 and 5.14

Explanation: $IC = [2 * (15+20+18+10)/80] - 1 = 0.72 = 0.575$; Breadth = $\sqrt{80} = 8.94$; Information Ratio = $0.575 * 8.94 = 5.14$

20. A Portfolio Manager is interested in protecting his portfolio of value Rs 200 million using options contracts available in the market. He calculated that he needs to pay a premium of Rs 5 Mn in order to fully hedge his portfolio. What kind of options contracts would he use to get the desired protection to his portfolio? If the value of portfolio drops by 10% by the date of maturity, what would be the loss mitigated because of the options?

- a) European Put Option, Rs.15 Mn
- b) European Call option, Rs.15 Mn
- c) European Put Option, Rs.20 Mn
- d) European Call Option, Rs. 20 Mn

Answer: a) European Put Option, Rs.15 Mn

Explanation: The “no hedge” situation would result in a loss of Rs 20 Mn in the portfolio value (= Rs 200 Mn * 10%). But when the portfolio value falls by 10%, his put

options would gain 10% (i.e., Rs 20 Mn gain from the options position), that would fully compensate the loss in portfolio value. However, as he has already paid a premium of Rs 5 Mn to set-up this options position, adjusting for this premium cost, he would have mitigated a portfolio loss of Rs 15 Mn (= Rs 20 Mn – Rs 5 Mn).

21. A portfolio generates 25% return during a particular year, with a volatility of 18%. In the same year, the benchmark index generated 22% with a volatility of 15%. In case the risk free rate of return during the same time is 8%, by how many basis points did the portfolio beat the benchmark? How do you measure the risk-adjusted performance between the two, and how much is it?

- a) 300; Sharpe Ratio; 0.01
- b) 300; Treynor Ratio; 0.025
- c) 300; Sharpe Ratio; 0.025
- d) 300; Treynor Ratio; 0.01

Answer: a) 300; Sharpe Ratio; 0.01

Explanation: The excess returns of the Portfolio are $25 - 8 = 17\%$; and that of market are $22 - 8\% = 14\%$. Therefore, the portfolio beat the benchmark by 300 basis points. On a risk adjusted basis the Sharpe ratio of the portfolio is $17/18 = 0.944$; and that of the market is $14/15 = 0.933$.

22. If a portfolio and the index display a volatility of 18% and 15%, respectively, for generating returns of 25% and 22% respectively. Do you think that the portfolio actually has beat the market adjusting its risk to that of the market? Assume a risk free rate of return to be 8%.

- a) Yes, by 0.167%
- b) No, it falls short by 6.4%
- c) Yes, approximately 17.4%
- d) No, it falls short by 0.167%

Answer: a) Yes, by 0.167%

Explanation: $M_{square} = [(25 - 8) * (15/18)] + 8 = 22.167$

Amount by which it beat the market is $M_{square} - (22) = 0.167\%$

Formula One for M Square = (Sharpe Ratio of the Portfolio * Standard Deviation of the Index)

Formula Two for M Square = [(Sharpe Ratio of the Portfolio * Standard Deviation of the Index)+Rf]

Formula Three for M Square = [(Std.Dev of Index / Std.Dev of Port) * (Return of Port)] + [(1 - (Std.Dev of Index / Std.Dev of Port))*Risk Free Rate]

23. A PMS manager receives Rs. 50 lakhs from a mutual benefit society to be invested in a portfolio of equity shares. Leaving Rs.5 lakhs in cash to encash opportune moments in the markets, the manager invests the rest in equal proportions in three equity shares K, L and M, each of which was bought at Rs.500, Rs.1000, and Rs.750 respectively. The manager would like to maintain the constant proportions strategy while rebalancing the portfolio at regular intervals. What action should the manager take when the prices of the three equity shares change to Rs.600, Rs.900, Rs.1200, (K, L, and M respectively), after 1 year?

- a) Buy K and L shares by Selling M
- b) Buy M and by Selling K and L shares
- c) Buy M and L shares by Selling K
- d) Sell K and L shares and buy M

Answer: a) Buy K and L shares by Selling M

Explanation: Arrive at the number of shares purchased at the beginning, Rs.15 lakhs allocated to each of the shares. Later identify the values of investment in each of the share and then bring back the investments to equal proportions at the new increased total portfolio value.

24. A PMS manager receives Rs. 50 lakhs from a mutual benefit society to be invested in a portfolio of equity shares. Leaving Rs.5 lakhs in cash to encash opportune moments in the markets, the manager invests the rest in equal proportions in three equity shares K, L and M, each of which was bought at Rs.500, Rs.1000, and Rs.750 respectively. The manager would like to maintain the constant proportions strategy while rebalancing the portfolio at regular intervals. What is the action prescribed w.r.t. equity share L. Roundup the number of equity shares?

- a) Buy 556 shares
- b) Buy 459 shares
- c) Sell 556 shares
- d) Sell 459 shares

Answer: a) Buy 556 shares

Explanation: Arrive at the number of shares purchased at the beginning, Rs.15 lakhs allocated to each of the shares. Later identify the values of investment in each of the share and then bring back the investments to equal proportions at the new increased total portfolio value. After that calculate the difference between the current value and desired value to find out how many shares need to be bought or sold at current price.

25. An investor approaches a PMS provider with a 5 year plan of investment. She starts with Rs.50 lakhs at the beginning of the first year. Later at the beginning of each year from the 2nd to 4th years, she invests Rs.45 lakhs, Rs.35 lakhs, Rs. 60 lakhs, and Rs. 50 lakhs. The fund created by the manager generates net annual returns of 15%, 12%, -

10%, -8%, 25%, for each of the 5 years, respectively, after all the charges. What is the time weighted rate of return to the investor ignoring taxes?

- a) 5.92%
- b) 6.80%
- c) 14%
- d) 13.84%

Answer: a) 5.92%

Explanation: Calculate the TWRR as $[(1.15) \times (1.12) \times (0.9) \times (0.92) \times (1.25)]^{1/5} - 1$

26. An investor approaches a PMS provider with a 5 year plan of investment. She starts with Rs.50 lakhs at the beginning of the first year. Later at the beginning of each year from the 2nd to 4th years, she invests Rs.45 lakhs, Rs.35 lakhs, Rs. 60 lakhs, and Rs. 50 lakhs. The fund created by the manager generates net annual returns of 15%, 12%, -10%, -8%, 25%, for each of the 5 years, respectively, after all the charges. What is the money weighted rate of return to the investor ignoring taxes?

- a) 6.09%
- b) 5.86%
- c) 5.92%
- d) 7.50%

Answer: a) 6.09%

Explanation: Use the Excel function of IRR where each year's cashflows are given as negative values and the final value of the fund is given as positive value, and some guess rate of return is given for EXCEL to calculate the return

27. An investor approaches a PMS provider with a 5 year plan of investment. She starts with Rs.50 lakhs at the beginning of the first year. Later at the beginning of each year from the 2nd to 4th years, she invests Rs.45 lakhs, Rs.35 lakhs, Rs. 60 lakhs, and Rs. 50 lakhs. The fund created by the manager generates net annual returns of 15%, 12%, -10%, -8%, 25%, for each of the the 5 years, respectively, after all the charges. What is simple arithmetic average rate of return for the investment horizon?

- a) 6.80%
- b) 6.09%
- c) 14%
- d) 13.84%

Answer: a) 6.80%

Explanation: Add all the returns with the sign and divide it by 5

28. A fund manager chooses an investment for an investor which has shown a historical correlation of 0.8 with the benchmark index. If the volatility of this investment is 20%,

and that of the benchmark index is 18%, the investor's tax bracket is 25%, the relevant risk free rate is 6%, and the historical market risk premium is 10%, then how much return should the manager generate on this investment (net of all charges and fees) before tax for the investor? Roundup the return to two decimals.

- a) 19.87%
- b) 18.67%
- c) 22.82%
- d) 20%

Answer: a) 19.87%

Explanation: $\text{Beta} = 0.8 * (20/18) = 0.89$; CAPM return expected by the investor = $6 + (0.89 * 10) = 14.9\%$. This is the post tax return. So for pre tax it should be $14.9 / 0.75 = 19.87\%$

29. An investor aged 40 years approaches a PMS manager with a request to manage his surplus wealth, which is left out after completely diversifying, and investing in all other traditional and required investments. This fund can be invested in a 100% equity portfolio. The fund manager creates such a portfolio which generates 25% return in the first year, when the relevant benchmark generated only 20%. However, the volatilities of both these portfolios were 22% and 15%. If the investor's portfolio displayed a correlation of 0.75 with that of the benchmark portfolio, and the relevant risk free rate was 6% for the 1 year period. What is the appropriate metric the fund manager should use to show his performance? (Choose between Sharpe's and Treynor's only)

- a) Treynor's Measure, 17.27%
- b) Treynor's Measure, 14%
- c) Sharpe's Measure, 0.85
- d) Sharpe's Measure 0.93

Answer: a) Treynor's Measure, 17.27%

Explanation: Only Treynor's measure has to be used because the investor has fully diversified his wealth, and return compensating systematic risk should suffice. $\text{Beta} = 0.75 * (22/15) = 1.1$. the Treynor's measure of the fund is $(25 - 6) / 1.1 = 17.27\%$; While that of the benchmark index is $(20-6)/1 = 14\%$; Fund Sharpe Ratio $(25-6)/20 = 0.85$; Index Sharpe Ratio = $(20-6)/15 = 0.933$

30. A portfolio manager is about to report the gross and net returns to the investor on a Rs. 50 lakhs investment made a year ago. The investor sets a target return of 15% and the portfolio manager negotiated a 20% management fee, over and above a fixed annual fee of 1.5% over the average value of asset under management. The other charges are 0.5% of the gross value of investment. What are the gross and net returns to be reported if the fund generated 20% during this year, with an exit load of 2%.

- a) 20% and 14.86%
- b) 19.9% and 14.86%
- c) 14.86% and 15%
- d) 22% and 15%

Answer: a) 20% and 14.86%

Explanation: Follow the illustration 20.2.4 in the study material.