Università Ca' Foscari di Venezia
Laurea Magistrale in Data Analytics for Business and Society
1. In the event of a liquidity trap, the LM curve:
   - A becomes a straight line parallel to the horizontal axis
   - B becomes a straight line parallel to the vertical axis
   - C is positively sloped
   - D is negatively sloped

2. In an IS-LM graph, an increase in the demand for money, with a constant money supply, results in:
   - A an increase in the interest rate and a decrease in production
   - B a decrease in the interest rate and an increase in production
   - C an increase in both the interest rate and production
   - D just an increase in the supply of goods

3. In the long run, with primary surpluses and a real GDP growth rate below the real interest rate, the debt-to-GDP ratio:
   - A can shrink
   - B cannot shrink
   - C is equal to 100%
   - D can only increase

4. All things being equal, a higher interest rate:
   - A reduces business investments
   - B increases business investment
   - C the number of profitable investment projects increases, comparing with the internal rate of return
   - D increases the internal rates of return on corporate investment projects

5. According to the theory of expectations, if the yield curve has a positive slope, the financial markets expect that:
   - A short-term interest rates rise in the future
   - B short-term interest rates fall in the future
   - C current interest rates are equal to the inflation rate
   - D short-term interest rates remain stable

6. Suppose the economic system is in a liquidity trap. If an expansionary monetary policy is implemented, it can be expected that the interest rate:
   - A does not change
   - B decreases
   - C increases
   - D in the short term always varies
7. Which are the areas included in the SWOT analysis?
   A. Opportunities, strengths, weaknesses and threats
   B. Threats, weaknesses, strategies and opportunities
   C. Strengths, weaknesses, options and threats
   D. Strengths, opportunities, technologies and weaknesses

8. Consumer markets and business markets:
   A. are very different from each other, from many points of view
   B. nowadays, they are different words for the B2B market
   C. differentiate from each other only if the final production is a product (consumer market) or a service (business market)
   D. generally share the same marketing difficulties and opportunities

9. The four elements of marketing mix are:
   A. product, price, promotion, place
   B. product, publicity, price, place
   C. price, partnership, promotion, publicity
   D. place, partnership, promotion, product

10. The marketing strategy and initiatives are:
    A. included in the marketing plan
    B. not included in the marketing plan
    C. included in the production plan
    D. not formalized in any document of the company due to privacy reason

11. The process by which managers select and manage aspects of structure and culture so that an organization can control the activities necessary to achieve its goals is called:
    A. organizational design
    B. organizational behaviour
    C. organizational environment
    D. organizational change

12. Segmentation enables:
    A. a specific marketing mix to be used for each client segment
    B. sales margins to be increased in the chosen segments
    C. new needs to be created in potential clients
    D. a marketing mix to be identified which can be applied to all clients
13. A shift along the indifference curve:
   A. leaves consumer satisfaction unchanged
   B. decreases consumer satisfaction
   C. increases consumer satisfaction
   D. represents a purchase of other assets

14. On which of the following factors does the supply function NOT depend?
   A. Consumer income
   B. Technological changes
   C. Price of the asset
   D. Cost of labor

15. The presence of economies of scale:
   A. is an important issue to consider in the industry entry strategy
   B. assesses the capability of the company in cost reduction
   C. is a company and not an industry item
   D. is less and less relevant due to increasing technology in industrial production

16. A market of perfect competition reaches its long-run equilibrium when:
   A. profits are zero
   B. costs are zero
   C. prices are maximum
   D. prices are equal to the minimum value of the total cost curve

17. What curve shows how much capital a firm demands that equals the marginal product of capital at its price?
   A. Capital demand curve
   B. Isocost of capital
   C. Capital expansion path
   D. Isoquant of capital

18. The short-run supply curve of a firm in perfect competition coincides with:
   A. the growing section of the marginal cost that lies above the average variable cost
   B. the entire marginal cost curve
   C. the entire average variable cost
   D. the growing section of the average variable cost
19. What is a variation in production that allows for greater output to be obtained with the same input?
   A. Technological progress
   B. Continuous production
   C. Elasticity of replacement
   D. Increasing returns to scale

20. In the event that buyers continue to buy even when prices rise, we speak of the following type of demand:
   A. rigid
   B. elastic
   C. fixed
   D. recessionary

21. Let \( A \) be an \( n \times n \) matrix and let \( \det(A) \) be its determinant. Which of the following is FALSE?
   A. If all elements on the main diagonal of \( A \) equal 0, then \( \det(A) = 0 \)
   B. If \( A \) is invertible, then \( \det(A) \neq 0 \)
   C. If \( \det(A) = 10 \), then \( \det(2A) = 10 \cdot 2^n \)
   D. If we let \( B \) be an \( n \times n \) matrix, then \( \det(AB) = \det(A) \cdot \det(B) \)

22. Find a linear approximation to \( f(x) = x^2 + 4x \) at \( x = -1 \).
   A. \( y = 7x + 2 \)
   B. \( y = 3x^2 + 4 \)
   C. \( y = 7x - 1 \)
   D. \( y = 3x + 4 \)

23. The derivative of \( \log[2 \log(2x)] \) equals to:
   A. \( 1/(x \log(2x)) \)
   B. \( 1/(x \log(x)) \)
   C. \( 1/[2 \log(2x)] \)
   D. \( 1/\log(2x) \)

24. Let the derivative of \( f(x) \) be \( f'(x) = x^2 - 4x \). On what intervals in \( \mathbb{R} \) is \( f(x) \) monotonically increasing?
   A. For \( x < 1/4 \)
   B. For \( 0 \leq x \leq 1/4 \)
   C. For \( x \leq 0 \) and \( x \geq 1/4 \)
   D. For \( 0 \leq x \leq 1/6 \)
25. Let \( f(x) = \sqrt[3]{x^2 - 3x} \). How many points of non derivability does \( f(x) \) have on \( \mathbb{R} \)?
   A. 2
   B. 0
   C. 1
   D. \( \infty \)

26. Find the partial derivatives of \( f(x,y) = e^{(3x+4y)} \) with respect to \( x \) and \( y \).
   A. \( \frac{\partial f}{\partial x} = 3e^{(3x+4y)}, \frac{\partial f}{\partial y} = 4e^{(3x+4y)} \)
   B. \( \frac{\partial f}{\partial x} = 3e^{x}, \frac{\partial f}{\partial y} = 4e^{y} \)
   C. \( \frac{\partial f}{\partial x} = 3e^{(3x)}, \frac{\partial f}{\partial y} = 4e^{(4y)} \)
   D. \( \frac{\partial f}{\partial x} = \frac{\partial f}{\partial y} = e^{(3x+4y)} \)

27. What is the hessian determinant of \( (x + 3y)^2 \)?
   A. 0
   B. 36
   C. 6
   D. 20

28. The contour lines of \( f(x,y) = x^2 + y^2 - 6y \), when they exist, are:
   A. circles of radius \( \sqrt{(k + 9)} \)
   B. circles of radius \( \sqrt{(k - 9)} \)
   C. ellipses of semi-major axis \( \sqrt{(k + 9)} \) and semi-minor axis \( \sqrt{(k - 9)} \)
   D. hyperbolae of semi-major axis \( \sqrt{(k^2 + 81)} \)

29. Answer the following question concerning IMAGE SS 07
   The limit shown in figure:
   A. is equal to 1/4
   B. does not exist
   C. is equal to \( +\infty \)
   D. is equal to \( -\infty \)
30. The function \( f(x,y) = x + y - xy + y^2 \):
- **A** is convex
- **B** is concave
- **C** is neither concave nor convex
- **D** is locally convex in a subset of its domain, but is not globally convex

31. Let \( f(x,y) = x^2 - 2y^2 \). The origin \( O(0;0) \) is:
- **A** a saddle point
- **B** a global maximum
- **C** a global minimum
- **D** a local maximum

32. A firm produces two amounts \( q_A \) and \( q_B \) of two goods, A and B. The total cost is given by the function \( f = (q_A)^2 + 2q_Aq_B + 2(q_B)^2 \). The two goods are sold at prices \( p_A = 30 \) and \( p_B = 50 \), respectively. For what amounts \( q_A \) and \( q_B \) does the firm achieve its maximum profit?
- **A** \( q_A = 5, q_B = 10 \)
- **B** \( q_A = 50, q_B = 100 \)
- **C** The profit function has no maximum
- **D** \( q_A = 100, q_B = 50 \)

33. Which of the following is the Lagrangian function associated to \( f(x) = 2x^2 + y^2 - 3x + y \), with the constraint \( x^2 + y^2 = 1 \)?
- **A** \( (2 + \lambda)x^2 + (1 + \lambda)y^2 - 3x + y - \lambda = 0 \)
- **B** \( (2 + \lambda)x^2 + (1 + \lambda)y^2 - 3x + y + \lambda = 0 \)
- **C** \( (2 + \lambda)x^2 + (1 + \lambda)y^2 - 3x + y = 0 \)
- **D** \( 1 - 3x + y = 0 \)

34. If we multiply two matrices \( A \) and \( B \), the rank of their product, i.e. \( r(AB) \), is always:
- **A** less than or equal to \( r(A) \) and \( r(B) \)
- **B** less than \( r(A) \) and \( r(B) \)
- **C** greater than or equal to \( r(A) \) and \( r(B) \)
- **D** greater than \( r(A) \) and \( r(B) \)

35. Let \( Ax = b \) be a system of \( n \) equations in \( n \) unknowns, where \( A \) is the coefficient matrix, \( x \) is the variable matrix, and \( b \) is the constant matrix. Let us represent the complete, or edged, matrix by \( Ab \). If the system has infinite solutions, then:
- **A** \( \text{rank}(A) = \text{rank}(Ab) < n \)
- **B** \( \text{rank}(A) = \text{rank}(Ab) = n \)
- **C** \( \text{rank}(A) > \text{rank}(Ab) < n \)
- **D** \( \text{rank}(A) > \text{rank}(Ab) \)
36. If you toss a fair coin five times, what is the probability of getting at least four heads?

A. 18.75%
B. 15.625%
C. 3.125%
D. 7.03%

37. What is the approximating normal distribution of a Bernoullian distribution \( B(n = 30, p = 0.4) \)?

A. \( N(\mu = 12, \sigma^2 = 7.2) \)
B. \( N(\mu = 30, \sigma^2 = 0.16) \)
C. \( N(\mu = 12, \sigma^2 = 51.84) \)
D. \( N(\mu = 30, \sigma^2 = 51.84) \)

38. A pastry shop is visited by 20 customers hourly. In any two minutes, what is the probability of at least two customers showing up?

A. 4.46%
B. 3.98%
C. 44.4%
D. 11.1%

39. In a Gaussian distribution, the probability \( P(\mu - 0.3\sigma < X < \mu) \) is 11.79%. What is the probability that \( X < \mu + 0.3\sigma \)?

A. 61.79%
B. 11.79%
C. 23.58%
D. 38.21%

40. Your favourite brand of crisps is running a promotion: one in each 5 bags of crisps will contain a small prize. You want to calculate the probability of getting at least one prize if you buy a certain amount of bags. What probability distribution should you apply to solve the problem?

A. A binomial distribution
B. A Poisson distribution
C. A Bernoulli distribution
D. A Gaussian distribution

41. A statistician calculates an estimate of the difference between two means coming from samples of two distinct populations, as well as its confidence interval at a given confidence level. Which of the following statements is correct?

A. If the variance of both samples were double, other things being equal, the confidence interval would increase by a factor \( \sqrt{2} \)
B. If the variance of both samples were double, other things being equal, the confidence interval would double
C. If the variance of both samples were double, other things being equal, the confidence interval would increase by a factor 4
D. If the variance of both samples were double, other things being equal, the confidence interval would shrink by a factor \( \sqrt{2} \)
42 In hypothesis testing, the significance level \( \alpha \) represents:

A. how much the sample value must be different from the null value before we can reject the null hypothesis
B. the probability of the sample value being equal to the population value
C. how much the sample value must be different from the null value in order to fully prove the null hypothesis
D. the deviation of the sample value from the null value

43 In hypothesis testing, a Type II Error means that:

A. we didn't reject the null hypothesis and it is false
B. we rejected the null hypothesis and it is true
C. we didn't reject the null hypothesis, and it is actually true
D. we rejected the null hypothesis and it is false

44 An algorithm is developed in order to estimate whether a firm asking for a loan is likely to default before repaying its debt. In the previous years, 3% of firms in the market have defaulted before repaying their debt. When trained on those historical data, the algorithm correctly rejects 97% of applications from those firms which have actually defaulted, but it also rejects 5% of applications from firms which have subsequently managed to fully repay their debt. If a firm's application is rejected by the algorithm, what is the probability that it actually defaulted?

A. 37.5%
B. 7.8%
C. 5.3%
D. 2.9%

45 An investor is interested in calculating covariance between two stocks, because he does not want to own stocks that tend to move in the same direction. The prices of Stock 1 over four consecutive years are 64.8, 65.1, 59.1 and 64.9; over the same years, the prices of Stock 2 are 4.95, 5.10, 4.92 and 5.08. What is the covariance of the two sets of data?

A. 0.147
B. 0.589
C. 0.212
D. 0.192

46 A fair coin is tossed 5 times. The probability of getting exactly 3 heads is:

A. 5/16
B. 3/5
C. 2/3
D. 1/32

47 Let \( A \) and \( E \) be two independent random events. If \( p(A) = 70\% \) and \( p(E) = 40\% \), the probability \( p(A \cap E) \) equals:

A. 42%
B. 70%
C. 12%
D. 88%
48. Let $X$ and $Y$ be two independent random variables. The variance of their difference equals:

- A) $\text{Var}(X) + \text{Var}(Y)$
- B) $\text{Var}(X) - \text{Var}(Y)$
- C) $0$
- D) $\text{Var}(X) \cdot \text{Var}(Y)$

49. Over the course of five years, the production output of a company sees an annual growth of $+12\%$, $+6\%$, $+2\%$, $+12\%$ and $+1\%$. What is the most appropriate measure of the average yearly growth rate?

- A) The geometric mean (approximately $+4.4\%$)
- B) The median ($+6\%$)
- C) The arithmetic mean ($+6.6\%$)
- D) The mode ($+12\%$)

50. Which of the following statements about the correlation coefficient of two variables is FALSE?

- A) The smaller the correlation coefficient, the weaker the correlation between the two variables
- B) If the correlation coefficient is close to zero, the two variables have a weak correlation with each other
- C) A correlation coefficient of 1 means a perfect positive correlation
- D) The minimum value for the correlation coefficient is $-1$