**1**. Derive a set of inequalities to describe the region:

a) Rectangular region with vertices at the given points

b) Parallelogram with vertices at the given points

c) Triangular region with vertices at the given points

d) Triangular region with vertices at the given points

**2**. A furniture company can sell all the tables and chairs it produces. Each table requires \_ hour in the assembly center and $\\_$ hours in the finishing center. Each chair requires $\\_$ hours in the assembly center and $\\_$ hours in the finishing center. The company’s assembly center is available \_ hours per day, and its finishing center is available \_ hours per day. If $x$ is the number of tables produced per day and $y$ is the number of chairs, find a system of inequalities describing all possible production levels. Sketch the graph of the system.

**3**. A store sells two models of a certain brand of computer. Because of the demand, it is necessary to stock at least twice as many units of model $A$ as units of model $B$. The cost to the store for the two models is $\_ and $\_, respectively. The management does not want more than $\_ in computer inventory at any one time, and it wants at least four model $A$ computers and two model $B$ computers in inventory at all times. Devise a system of inequalities describing all possible inventory levels, and sketch the graph of the system.

**4**. A person plans to invest no more than $\_ in two different interest-bearing accounts. Each account is to contain at least $\_. Moreover, one account should have at least twice the amount that is in the other account. Find a system of inequalities to describe the various amounts that can be deposited in each account, and sketch the graph of the system.

**5**. Two types of tickets are to be sold for a concert. One type costs $\_ per ticket and the other type costs $\_ per ticket. The promoter of the concert must sell at least \_ tickets including \_ of the $\_ tickets and \_ of the $\_ tickets. Moreover, the gross receipts must total at least $\_ in order for the concert to be held. Find a system of inequalities describing the different numbers of tickets that can be sold, and sketch the graph of the system.

**6**. A small community includes a farmer, a baker, and a grocer, and has the input-output matrix $A$ and external demand matrix $E$ shown below

Farmer Baker Grocer

$$A=\left[\begin{matrix}a\_{11}&a\_{12}&a\_{13}\\a\_{21}&a\_{22}&a\_{23}\\a\_{31}&a\_{32}&a\_{33}\end{matrix}\right]\begin{matrix}Farmer\\Baker\\Grocer\end{matrix}$$

$$E=\left[\begin{matrix}e\_{1}\\e\_{2}\\e\_{3}\end{matrix}\right]$$

Solve for the output matrix $X$ in the equation $X=AX+E$.

**7**. A system composed of two industries, coal and steel, has the following input requirements;

(a) To produce $\_ worth of output, the coal industry requires $\_ of its own product and $\_ of steel.

(b) To produce $\_ worth of output, the steel industry requires $\_ of its own product and $\_ of coal.

Find $A$, the input-output matrix for this system. Then solve for the output matrix $X$ in the equation $X=AX+E$, where the external demand is

$$E=\left[\begin{matrix}e\_{1}\\e\_{2}\end{matrix}\right]$$

**8**. Find the least squares regression line for the given set of data points on the plane.

**9**. Sketch the line that appears to be the best fit for the given points (see the figure)



(a) use the method of least squares to find the least squares regression line

(b) calculate the sum of the squared error.

**10**. A fuel refiner wants to know the demand for a certain grade of gasoline as a function of the price. The daily sales (in gallons) for three different prices of the product are shown in the table

|  |  |  |  |
| --- | --- | --- | --- |
| Price (x) | $2.00 | $2.25 | $2.50 |
| Demand (x) | 3500 | 2750 | 2300 |

(a) Find the least squares regression line for these data.

(b) Estimate the demand when the price is $2.40.

**11**. Locate the real roots of the given function $f\left(x\right)$ graphically using the built-in drawing capabilities of the Excel.

**12**. Determine the real root of the given function $f\left(x\right)$ using bisection method. Employ the initial guesses of $x\_{l}=a$ and $x\_{u}=b$ and iterate until the estimated error $ε$ is achieved. Give the statistics of problem solving.

**13**. Determine the real root of the given function $f\left(x\right)$ using interval method with linear interpolation. Employ the initial guesses of $x\_{l}=a$ and $x\_{u}=b$ and iterate until the estimated error $ε$ is achieved. Give the statistics of problem solving.

**14**. Determine the real root of the given function $f\left(x\right)$ using the Newton-Raphson method. Employ the initial guess of $x\_{s}=a$ and iterate until the estimated error $ε$ is achieved. Give the statistics of problem solving.

**15**. Estimate the real root of the of the given function $f\left(x\right)$ using the built-in back-solving capabilities of the Excel. Set the maximum change of the solution to $ε$ and the limit on the maximum number of iterations to $N$. The initial guess of the solution should be entered into a cell in the spreadsheet.

**16**. Estimate the real root of the given function $f\left(x\right)$ using the secant method. Employ the initial guesses of $x\_{0}=a$ and $x\_{1}=b$, and iterate until the estimated error $ε$ is achieved. Give the statistics of problem solving.

**17**. Solve the given system of linear equations by applying the matrix computations in Excel. If the system does not a solution, print an error message.

**18**. Apply the Gauss-Seidel iterative method to find the solution of the given system of linear equations implemented in Excel.

**19**. Apply the Jordan iterative method to find the solution of the given system of linear equations implemented in Excel.

**20**. Write a VBA procedure in Excel for checking out whether the Gauss-Seidel and Jordan methods are applicable to the given system of linear equations. The condition is that the coefficient matrix of the system should ne diagonally dominant. (The coefficient matrix of the system is assumed to be entered into the adjacent cells on the worksheet)

**21**. Apply the geometric method for solving the following optimization problem: A merchant plans to sell two models of home computers at costs of $\_ and $\_, respectively. The $\_ model yields a profit of $\_ and the $\_ model yields a profit of $\_. The merchant estimates that the total monthly demand will not exceed \_ units. Find the number of units of each model that should be stocked in order to maximize profit. Assume that the merchant does not want to invest more than $\_ in computer inventory.

**22**. Apply the geometric method for solving the following optimization problem: A farming cooperative mixes two brands of cattle feed. Brand X costs $\_ per bag and contains \_ units of nutritional element A, \_ units of element B, and \_ units of element C. Brand Y costs $\_ per bag and contains \_ unit of nutritional element A, \_ units of element B, and \_ units of element C. Find the number of bags of each brand that should be mixed to produce a mixture having a minimum cost per bag. The minimum requirements of nutrients A, B, and C are \_ units, \_ units, and \_ units, respectively.

**23**. Use the simplex method to find the maximum value of the given criterion merit

$$z=ax\_{1}+bx\_{2}+cx\_{3}$$

subject to the set of constraints, where $x\_{1}, x\_{2}, x\_{3}\geq 0$.

**24**. Solve the following polynomial curve-fitting problem: Find a fourth-degree polynomial

$$p\left(x\right)=a\_{0}+a\_{1}x+a\_{2}x^{2}+a\_{3}x^{3}+a\_{4}x^{4}$$

that fits the given set of points.

**25**. Set up a system of equations and the criteria merit for the following transportation problem: The uniform cargo is concentrated at $2$ suppliers in quantities \_ and \_, respectively. This cargo is to be delivered to $3$ consumers in volumes \_, \_, and \_, respectively. The costs $c\_{ij}$, $i=1,2$, $j=1,2,3$, of transportation of each unit of cargo from a supplier to a consumer are given in the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| ConsumerSupplier | \_ | \_ | \_ |
| \_ | A | B | C |
| \_ | D | E | F |

You are required to make a transportation plan, by which the reserves of all suppliers are exhausted completely, the needs of all consumers are satisfied in full, and the total cost of transportation is minimal.

**26.** Write a VBA procedure that finds the maximum and minimum values in a selection of the spreadsheet.

**27.** Write a VBA procedure that counts the number of times a specific data occurs in a selection of the spreadsheet.

**28.** Write a VBA procedure that multiples two matrices selected in the spreadsheet.

**29.** Write a VBA procedure that selects (or highlights) the column in the spreadsheet containing the largest sum of its elements.

**30.** Write a VBA procedure that highlights all the cells in the spreadsheet containing negative values.

**31.** Determine whether the list contains yellow or black cars, produced after \_ (year), and the price tag is in the range of $\_ – $\_ (apply the corresponding filter in Excel).

**32.** Determine whether the list contains cars that were produced after \_ (years) and the mileage is more than \_ (km) but less than \_ (km), or black \_ (model), whose price is greater than $\_, but less than $\_ (apply the corresponding filter in Excel).

**33.** Determine the cars of the white or black color, the price of which is less than the average price of all cars, and the mileage is greater than or equal to the average mileage of all cars in the list (apply the corresponding filter in Excel).

**34.** Find all occurrences of a given word in the current column of the worksheet and replace them with a specific keyword.

**35.** Perform the following operations in Excel by using built-in or user-defined functions:

a) The column A contains the full names of the staff members. Divide these names into Firstname, Surname, and Patronymic, and enter them into the adjacent columns B, C, and D.

|  |  |  |  |
| --- | --- | --- | --- |
| **A** | **B** | **C** | **D** |
| Tom Ford Junior | Tom | Ford | Junior |
| Ron Doyle Ted | Ron | Doyle | Ted |

b) The column A contains the full names of the staff members. In the adjacent cells (column B) obtain the short name of the member consisting of the Surname and his/her initials

|  |  |
| --- | --- |
| **A** | **B** |
| Tom Ford Junior | Ford T.J. |
| Ron Doyle Ted | Doyle R.T. |

c) The column A contains the 7-digit telephone numbers of the staff members in the format ####### (for example, 1234567). In the adjacent cells (column B) obtain the telephone numbers written in the usual manner, i.e. in the format ###-##-## (for example, 123-45-67).

**36.** Build a graph (chart diagram) of the function $y=ax^{2}+bx+c$ on the interval $\left[x\_{1},x\_{2}\right]$, where the values of the parameters $a,b,c,x\_{1},$ and $x\_{2}$ are written in separate cells.

**37.** The table in Excel contains information about the number of workers (in thousands) in each of the five branches of the company. Build two pie charts reflecting the given information: 1) in numbers of workers at each branch and 2) in percentage of the total number of workers.

**38.** Based on the text entered into the cell A1, you need to build a histogram (chart) of letters that occur in this text. Use VBA to count the number of times each symbol occurs in the text.

**39.** Using VBA and Excel built-in facilities, organize the transposition of the matrix entered into the worksheet.

**40.** Using VBA and Excel built-in facilities, organize the addition and subtraction of two matrices entered into the worksheet.

**41.** The table of data contains information about students of different groups sorted by the group names. Write a VBA procedure that will insert blank lines between students of different groups.

**42.** Using VBA and Excel built-in facilities, insert automatically arithmetic and geometric series into the worksheet.

**43.** Using VBA and Excel built-in facilities, insert progression of dates into the worksheet organized by days, weekdays, months, and years.

**44.** List all the possible types of loops available in VBA and describe how they work.

**45.** List all the possible types of conditional operators available in VBA and describe how they work.

**46.** List all the possible ways of declaring arrays in VBA, and describe the procedures and functions for working with arrays.

**47.** List all the possible string operations and corresponding functions supported by VBA, and describe briefly their functionality.

**48.** List all the possible operations and corresponding functions performed on dates supported by VBA, and describe briefly their functionality.

**49.** List all the possible features of Procedures and Functions in VBA, that is how to define them, how to pass arguments by value and by reference, how to use optional arguments, etc. Then describe the widely used built-in functions and procedures in VBA: MsgBox, InputBox, etc.

**50.** List all the possible features of Variables, Data Types, Constants in VBA, that is how to declare local, global, module-wide, and static variables and constants; define the scope and lifetime of the variables, describe data types supported by VBA, etc.

**51**. What are the four major components of an information system? (give a brief description of each)

**52**. What qualities must have information to be useful? (give a brief explanation for each)

**53**. What are the most popular jobs in the information systems field? (describe briefly the role of each job)

**54**. Perform the following tasks:

(a) List memory devices that are non-volatile (describe briefly how information is stored in each device)

(b) List memory devices that are volatile (place them in order of their speed)

**55**. What kind of operations are performed by the Central Processing Unit? (describe briefly each operation)

**56**. What are the major components a typical computer system? (describe briefly the functionality of each component)

**57**. List the well-known input devices (describe briefly the functionality of each input device)

**58**. List the well-known output devices (describe briefly the functionality of each input device)

**59**. List the components of the control programs of a typical operating system and describe the functions they perform

**60**. List the well-known categories of commercial application software for personal computers (describe briefly what they are used for)

**61**. List all types of computer languages that people can use to write programs (order them by the degree of ease of writing programs and give an example of each language)

**62**. What kind of software relates to the systems software of a computer? (give several examples for each)

**63**. What are three factors that define the power of computers? (describe the distinguishable features of each)

**64**. Answer the following questions

(a) What part of a computer system serves as a work area to store a program and its data while the program is running?

(b) What part of a computer system can hold data for long periods of time, even when there is no power to the computer system?

(c) What do you call a program that performs a specialized task, such as a virus scanner, a file compression program, or a data backup program?

(d) What kind of software are Microsoft Word, Excel, PowerPoint, Access?

**65**. Answer the following questions

(a) What is a file in a database?

(b) What is record in a database?

(c) What is called a data hierarchy?

(d) What is called a database?

**66**. List the typical components of a Database Management System (describe briefly the role of each component)

**67**. What type of data models are used for designing a database? (give a brief description of each model)

**68**. Which access methods are used in a database? (give a brief description of each access method)

**69**. Answer the following questions

(a) Which SQL operator is used for inserting records into a database (give the general syntax of this operator)

(b) Which SQL operator is used for updating records in a database (give the general syntax of this operator)

(c) Which SQL operator is used for deleting records in a database (give the general syntax of this operator)

(d) Which SQL operator is used for retrieving records from the database (give the general syntax of this operator)

**70**. Suppose that you have to design a hierarchical model for the database that would include information about suppliers, the product lines they provide, the categories of each product, and specific products in each category. Sketch the hierarchical model for this database. (include in the sketch at least three suppliers, at least three product lines, at least four categories of products, and at least five specific products).

**71**. The sample table below shows 11 of the students enrolled in a MIS course.



Write SQL-statements to perform the following tasks:

(a) list all ACC majors

(b) list all ACC majors with a GPA higher than \_

(c) list all students who are MIS or ACC majors

(d) list all students who aren’t ACC majors

(e) describe the possible data type for each field in the given table

**72**. Answer the following questions

(a) Which SQL-clause is used for filtering records retrieved from a database table?

(b) Which SQL-clause is used for sorting records retrieved from a database table in an ascending order?

(c) Which SQL-clause is used for sorting records retrieved from a database table in an descending order?

(d) Which SQL-operator(s) is/are used for concatenating several fields of records retrieved from a database table?

(e) Which SQL-clause is used for grouping records retrieved from a database table?

**73**. A database table “Employees” consists of the following fields:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Social Security ID | First Name | Last Name | Address | Zip Code | Area Code | Phone Number | Salary |
| … | … | … | … | … | … | … | … |

(a) Write an SQL-statement for calculating the total amount of only those employees’ salaries whose salaries exceed the average value of salary.

(b) Write an SQL-statement to retrieve all the records from the “Employees” table whose last names begin with “\_…”

(c) Write an SQL-statement to retrieve all the records from the “Employees” table whose “Phone Number” field is empty (not specified).

(d) Write an SQL-statement to retrieve all the records from the “Employees” table whose “Area Code” field is not empty (specified).

**74**. A database table “Students” consists of the following fields:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Student ID | First Name | Last Name | Patronymic | Age | Major | GPA |
| … | … | … | … | … | … | … |

(a) Write an SQL-statement to retrieve all the records from the “Students” table grouped by their age.

(b) Write an SQL-statement to delete all the records from the “Students” table whose GPA is either below \_ or above \_.

(c) Write an SQL-statement to update all the records from the “Students” table by increasing each student’s age by \_.

(d) Write an SQL-statement to update all the records from the “Students” table by increasing each student’s GPA by \_%.

**75**. The college has been organizing the information about how well students performed at different courses in a text file that has the following table structure:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| StudentID | StudentName | StudentSurname | StudentAge | StudentGender | StudentStatus | Major | GPA | GroupNumber | Course | Score |
| 112233 | Mary | Jones | 19 | F | Freshman | MIS | 2.79 | 123.4 | CS-0 | 78 |
| 112233 | Mary | Jones | 19 | F | Freshman | MIS | 2.79 | 123.4 | CL-1 | 88 |
| 112233 | Mary | Jones | 19 | F | Freshman | MIS | 2.79 | 123.4 | AG-1 | 91 |
| 223344 | Tom | Smith | 20 | M | Junior | ACC | 3.14 | 124.5 | CS-1 | 76 |
| 223344 | Tom | Smith | 20 | M | Junior | ACC | 3.14 | 124.5 | AC-1 | 84 |
| … | … | … | … | … | … | … | … | … | … | … |

Now the college decides to organize this information in a database. You need to design the relational model for this database by

1. Eliminating duplicated fields from the same table
2. Creating separate tables for each group of related data
3. Identifying each record with a unique field (the primary key)

Describe how you could accomplish this set of tasks.