**Q1:** Calculate LU decomposition to solve the following system of equations:

$$x_1 + x_2 + x_3 = 1 \qquad (1)$$

$$4x_1 + 3x_2 - x_3 = 6 \qquad (2)$$

$$3x_1 + 5x_2 + 3x_3 = 4 \qquad (3)$$

**Q2:** if B is orthogonal matrix, show that [B]= ±1

Q3: use the data linearization method to find the exponential fit $y=C\ e^{Ax}$ for the given data:

| x | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| y | 1.5 | 2.5 | 3.5 | 5 | 7 |

**Q4:** define four (4) of the following : 1- Jacobi iterative method 2- unitary matrix 3- relational expressions 4- Newton backward interpolation 5- null matrix

Q5: given the following table of values.

| x | 10 | 20 | 30 | 40 | 50 |
|---|---|---|---|---|---|
| y | 22 | 30 | 41 | 55 | 68 |

Find the difference table using Newton forward interpolation, then evaluate f(25)

**Q6:** Find the inverse of matrix A by elementary row operation. $A = \begin{bmatrix} 4 & 1 & 2 \\ 5 & 2 & 1 \\ 1 & 0 & 3 \end{bmatrix}$

**Q7:** write three ways for initializing vectors in Matlab.

**Q8:** write the flowchat of the statement (if …. elseif …… else ……. end)

**Q9:** show that: 1- every eigenvalue of an Hermitian matrix is real 2- different eigenvectors of an Hermitian matrix corresponding to two distinct eigenvalues are orthogonal to each other.

**Q10:** Find the inverse of matrix **A** by adjoint matrix. $\boldsymbol{A} = \begin{bmatrix} 1 & -1 & 2 \\ 4 & 0 & 6 \\ 0 & 1 & -1 \end{bmatrix}$

**Q11:** for Dirac matrix prove $\sigma_l\ \sigma_m = i\ \sigma_n$

**Q12:** Find the Lagrange interpolation polynomial that takes the values prescribed below

| x | 0 | 1 | 2 | 4 |
|---|---|---|---|---|
| f(x) | 1 | 1 | 2 | 5 |

Q13: Given the following data

| x | 3 | 4 | 5 |
|---|---|---|---|
| y | 3 | 8 | 7 |

Find the least square fitting.

**Q14:** put true ( T) or false (F) in front of the following sentences:

1- A diagonal matrix is a square matrix where all its elements zeros, except for those in the reverse main diagonal.

2- The least square method is restricted to a linear polynomial.

3- Eigenvectors of different eigenvalues are orthogonal to one another.

4- An Inner product is a Bra multiplied by a Ket.

5- The complex equivalent of an orthogonal matrix is the normal matrix.

6- The cofactors of a square matrix A is the transpose of the Adjoint matrix.

7- If and only if $\det(A) \neq 0$ , then the square matrix A is singular.

**Q15:** Find the solution of the following system of linear equations, using Gauss-elimination method.

$$3x_1 + x_2 = 2 \qquad (1)$$

$$x_2 + 3x_3 = 3 \qquad (2)$$

$$x_1 - x_2 + 4x_3 = 5 \qquad (3)$$

**Q16:** if $A = \begin{bmatrix} 0 & 1 & 2 \\ a & 0 & 3 \\ b & c & 0 \end{bmatrix}$ is a skew-symmetric matrix, find a , b and c .

**Q17:** For the Pauli matrices, show that $\sigma_m \sigma_n + \sigma_n \sigma_m = 2 I \delta_{mn}$ , where $\delta_{mn}$ is kronecker delta

**Q18:** Given the data :

| x | 1 | 2 | 2.5 | 3 |
|---|---|---|---|---|
| y | 3.7 | 4.1 | 4.3 | 5 |

Find the least square fitting to these data

**Q19:** write the work of the following functions and commands :

1- eye (m,n) 2- abs(x) 3- prod(x) 4- tril (y) 5- format bank

**Q20:** Find the inverse of matrix A by adjoint matrix. $A = \begin{bmatrix} 4 & 1 & 2 \\ 5 & 2 & 1 \\ 1 & 0 & 3 \end{bmatrix}$

**Q21:**write three ways for drawing multiple plots on the same set of axes.

**Q22:** write the flowchat of the statement (switch…… case)

**Q23**: show which of the following matrices singular or non-singular.

1- $A = \begin{bmatrix} 4 & 0 & 3 \\ 5 & 1 & 2 \\ -1 & 6 & 2 \end{bmatrix}$ 2- $A = \begin{bmatrix} 0 & 2 & -1 \\ 3 & -2 & 1 \\ 3 & 2 & -1 \end{bmatrix}$

**Q24:** what are the ways of drawing multiple plots on the same set of axes.

**Q25:** what are the main difference between functions (display and fprintf)

Q26: what are the work of the following: 1- nthroot (z,n) 2- rem (y,x) 3- triu (f) 4- grid 5- fplot

**Q27:** fill the blanks with correct answer:

1- The function ---------- is use to rounding the result toward zero.

round b- fix c- floor d- ceil

2- The max. length of variable name in matlab is ---------- character .

a- 32 b- 31 c- 30 d- 33

3- title('text') :writes the text as a title on -------- of the graph.

a- Right b- Left c- Top d- down

4- If you need to set the same scale for both axes, we use command ---------- .

a- axis square axis tight c- axis equal d- axis ([ $x_{min}$ $x_{max}$ ])

5- If we are plotting two graphs on the same axes, we may find ---------- useful. It allows to have independent y-axis labels on the left and right.

Ploty (x,y) b- plotyy(x,y) c- plot( x1,y1,x2,y2) d- plot(y)

**Q28:** write the flowchart of ( if ---- elseif ----- else -----end)

**Q29:** what are the ways to entering variables to Matlab .

Q30: what are the work of the following: 1- A(:,S:R) 2- conj(t) 3- rot90(B,3)

4- hist(F,4) 5- csch(h)

**Q31:** Define the following: 1-Upper triangular matrix 2- orthogonal matrices
3- orthogonally diagonalizable 4- isempty(x) logical function 5- histogram

**Q32:** prove that the interchange of any two rows will alter the sign but not the numerical value of a determinant

**Q33:** find the solution of the following system of equations by matrix inversion.

$$x_1 + x_2 + x_3 = 1 \qquad (1)$$
$$4x_1 + 3x_2 - x_3 = 6 \qquad (2)$$
$$3x_1 + 5x_2 + 3x_3 = 4 \qquad (3)$$

**Q34:** show that the following matrix is Hermitian matrix:

$$A = \begin{bmatrix} 3 & 1-i & -i \\ 1+i & -2 & 2+i \\ i & 2-i & 5 \end{bmatrix}$$

Q35: describe this plot:

```
plot(z,p,':sk','LineWidth',6,'markersize',10,'MarkerEdgeColor',
'c','markerfacecolor','b')
```

**Q36:** Find the inverse of matrix x by elementary row operation. $A = \begin{bmatrix} 4 & 1 & 2 \\ 5 & 2 & 1 \\ 1 & 0 & 3 \end{bmatrix}$

**Q37:** show that : 1- every eigenvalue of an Hermitian matrix is real 2-different eigenvectors of an Hermitian matrix corresponding to two distinct eigenvalues are orthogonal to each other.

**Q38:** write the flowchat of the statement (if…elseif…else…end)

**Q39:** for Dirac matrix prove $\sigma_l \ \sigma_m = i \ \sigma_n$

**Q40:** If **B** is orthogonal matrix, show that [**B**] = ±1

**Q41:** Choose the correct answer:

1- The complex equivalent of an orthogonal matrix is the ---------- matrix.

a- Symmetric b- Hermition c- unitary d- normal

2- In determinant rules: the addition of a multiple of any row to another row will ----------

a- alter the sign but not its numerical value b- leave it unaltered

c- make determinant zero d- changed its value

3- Any square matrix may be written as the sum of :

a- symmetric & orthogonal matrices c- symmetric & skew-symmetric matrices
b- unitary & normal matrices d- orthogonal & normal matrices

4- A square matrix where all its elements zeros, except for those in the main diagonal is called ----------

a- Identity b- null c- diagonal d- symmetric

5- The simplest method to find inverse of the matrix is by:

a- Adjoint method b- Crammer method c- elementary row operation d- matlab prog.

**Q42:** Find the inverse of matrix A by elementary row operation. $A = \begin{bmatrix} 0 & 2 & -1 \\ 3 & -2 & 1 \\ 3 & 2 & 1 \end{bmatrix}$

**Q43:** For Dirac matrices, prove that $\sigma_l \ \sigma_m = i \ \sigma_n$.

Q44: write the flowchat of the statement (switch ….case)

**Q45:** for the given data:

| X | 1 | 2 | 3 |
|---|---|---|---|
| f(x) | 8 | 4 | 7 |

Find the Lagrange interpolation polynomial $p_n(x)$ of these data points, then estimate f(x) for x=2.5

Q46: Define the following :

1- Orthogonally diagonalizable 2- normal matrix 3- skew-symmetric matrix

4- outer product 5- relational expressions

Q46: for the given data, find the f(25), of these data points using Newton forward interpolation polynomial.

| $x$ | 10 | 20 | 30 | 40 | 50 |
|---|---|---|---|---|---|
| $y = f(x)$ | 46 | 66 | 81 | 93 | 101 |