1. Compute the determinant of matrix A

$$A = \begin{pmatrix} 2 & -4 \\ -6 & -8 \end{pmatrix}$$

a) 40
b) -40
c) 36
d) -36

2. Find the inverse of the following matrix X.

$$X = \begin{pmatrix} \frac{2}{3} & \frac{-1}{2} \\ \frac{1}{2} & \frac{3}{2} \end{pmatrix}$$

a) $\begin{pmatrix} \frac{4}{5} & \frac{-8}{5} \\ \frac{8}{5} & \frac{4}{5} \end{pmatrix}$
b) $\begin{pmatrix} \frac{8}{5} & \frac{-4}{5} \\ \frac{1}{2} & \frac{1}{4} \end{pmatrix}$
c) $\begin{pmatrix} \frac{-2}{3} & \frac{1}{2} \\ \frac{-1}{2} & \frac{3}{2} \end{pmatrix}$
d) $\begin{pmatrix} \frac{6}{5} & \frac{2}{5} \\ \frac{-2}{5} & \frac{8}{15} \end{pmatrix}$

3. Divide the complex numbers and express the result in the standard form, a+bi, where a and b are fractions in lowest terms.

$$\frac{19 + 8i}{28 - 4i}$$

a) $\frac{5}{8} + i\frac{3}{8}$
b) $\frac{5}{8} - i\frac{3}{8}$
c) $\frac{2}{3} - i\frac{1}{2}$
d) $\frac{2}{3} + i\frac{1}{2}$

4. Compute the determinants of matrix B

$$B = \begin{pmatrix} -\frac{1}{3} & 1 \\ 4 & -8 \end{pmatrix}$$

a) $\frac{-1}{4}$
b) $\frac{-3}{4}$
c) $\frac{-4}{3}$
d) $\frac{1}{4}$

5. Calculate the derivate of the function directly from the definition.

$$f(x) = \frac{3x^2 + x - 1}{x - 3}$$

a) $\frac{3x^2-18x-2}{(x-3)^2}$
b) $\frac{3x^2-18x-2}{x-3}$
c) $\frac{3x^2-1}{(x-3)^2}$
d) $\frac{3x^2-1}{x-3}$

6. Calculate the derivate of the function directly from the definition.

$$f(x) = x^3 + 16x - 2$$

a) $5x^2 + 2$
b) $3x^2 - 16$
c) $5x^2 - 2$
d) $3x^2 + 16$

7. Calculate the following limit:

$$\lim_{x \to 0} \left(\frac{5 \tan(x)}{2x} \right)$$

a) ∞
b) 2.5
c) 5
d) 2

8. Calculate the following limit:

$$\lim_{x \to 4} \left(\frac{5.6x^2 + 3x - 1}{x} \right)$$

a) ∞
b) 8.4
c) 2.6
d) 0

9. Write the complex number in polar form with argument θ between 0 and 2π.

$$6 - 4i\sqrt{5}$$

a) $r = 10.77;\ \theta = 66.15°$
b) $r = 10.77;\ \theta = 56.15°$
c) $r = 10.77;\ \theta = -66.15°$
d) $r = 10.77;\ \theta = -56.15°$

10. Find the inverse of the following matrix X.

$$X = \begin{pmatrix} \frac{3}{4} & \frac{-1}{3} \\ \frac{1}{2} & -\frac{1}{2} \end{pmatrix}$$

a) $\begin{pmatrix} -1 & \frac{1}{3} \\ \frac{-1}{2} & 1 \end{pmatrix}$
b) $\begin{pmatrix} \frac{3}{4} & \frac{1}{2} \\ \frac{1}{3} & \frac{1}{2} \end{pmatrix}$
c) $\begin{pmatrix} \frac{12}{5} & \frac{-8}{5} \\ \frac{12}{5} & \frac{-18}{5} \end{pmatrix}$
d) $\begin{pmatrix} \frac{3}{5} & 12 \\ \frac{-12}{5} & \frac{-18}{5} \end{pmatrix}$

11. Which one of the following lists contain only the legal MATLAB variable names?
    a) year-2012, time
    b) myTime, 1stVar
    c) MyScore1, student1_ID
    d) 2nd_Var, my_currency
    e) a) and b)
12. Index of an array in MATLAB start with.
    a) 2
    b) 0
    c) 1
    d) -1
13. What is output of A = [1 0 2]; b = [3 0 7]; c=a.*b?
    a) [3 0 14]
    b) [14 0 3]
    c) [7 0 3]
    d) [2 0 21]
14. What is the value of 'a' at the end of 9th loop in the following for loop code?

```
a=2.3;
for i=1:1:14
        a=round((a*1.5*i)-2.2)
end
```

a) 29
b) 28
c) 25
d) 31
e) a) and b)

15. What are the following functions can be performed using MATLAB?
    a) Performing very simple calculations
    b) Plotting mathematical relationships in two dimensional and three dimensional
    c) For operations of matrix
    d) All of the above
16. What is the output for A in [A>6] =6?
    a) 7
    b) Not valid
    c) 6
    d) 7&6
    e) inf
17. Which of the following is used to see if two elements are equal in MATLAB?
    a) !=
    b) isequal
    c) =
    d) ==
    e) All of the above
18. Which of the following is proper *if statement* operator in MATLAB?
    a) &&
    b) ==
    c) >=
    d) <=
    e) All of the above
19. Which of these is the way to access all elements in a vector named V (assuming there is at least one element in the vector)?
    a) V(1)
    b) V(0)
    c) V(:)
    d) V(:==)
    e) None of the above
20. What is the ans on the command window for the following while loop:

```
b=0;
while b<40
b=b+1;
end
c=(b*4*pi);
disp(b)
```

    a) 8.8
    b) 40

c) 41
d) 10.5
e) 4.1

21. In MATLAB, given a vector V, the function size(V)= [row# column#]. Given V= [1,3,4,5:6,7,8,9]. What is the value of b and be if this code is entered into MATLAB>> [a b] = size(vector)?
    a) 4
    b) 7
    c) 2
    d) 5
    e) b) and c)
22. Which of the following determines the number of elements N of the matrix B?
    a) N = numofelement(B)
    b) N = elem(B)
    c) N = length(B)
    d) Both a) and b)
23. The output of the command cat= ['cat' 'dog'] is.
    a) cat dog
    b) cat==dog
    c) cat&dog
    d) catdog
    e) a) and b)
24. What is the equivalent of *if* in an *if statement* for a *switch case statement?*
    a) case
    b) C 2
    c) case repeat
    d) else
    e) otherwise
25. Let x and y be solutions to a system of n homogeneous linear equations. If z = ax + by?
    a) There are at most 2 leading variables
    b) z is a solution to the system for all a and b
    c) The solution has n - 2 parameters
    d) z is a solution only if a = 0 and b = 0
    e) None of the above
26. What is the ans of the following operation

    A= [2,3,5,6];
    B= [3,2,4,5];
    C=round (A./B)

    a) C= 6 6 20 30
    b) C= 1 2 1 1
    c) C= 12 43 54 4
    d) C=4 4 5 5
    e) b) and d)
27. Given two row vectors A and B as shown below. What is the operation for concatenating A and B and forming a new vector C.

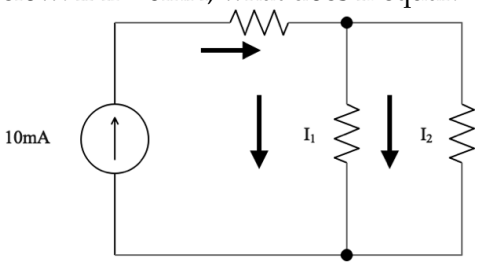
a) C= [A / B]
b) C= [A*B]
c) C= [A==B]
d) C= [AB]
e) C= [A B]

28. Convert the Following.
    i. 123.45610 = ( )$_2$ [To five decimal places]
    ii. (11101.10101)$_2$ = ( )$_{16}$ [To two decimal places]
        a) (1111011.01110)$_2$ and (1D. A8)$_{16}$
        b) (1111211.03211)$_2$ and (1C. 38)$_{16}$
        c) (121132.00111)$_{16}$ and (2B. 21)$_{16}$
        d) a) and c)
29. Perform the following binary subtraction using 6-bit 2's complement addition.
    i. 27-6
    ii. 15-18
        a) 111101 and 010111
        b) 010101 and 111101
        c) 010101 and 110011
        d) None of the above
30. Write down the signed and unsigned range of possible values for 4 bit, 6 bit and 8 bit 2's complement representation.
    a) -8 to 7, -32 to 31, and -124 to 127
    b) -9 to 10, -31 to 23, and -120 to 142
    c) -8 to 7, -32 to 31, and -128 to 127
    d) -8 to 9, -32 to 32, and -128 to 127
31. Convert the following.
    (4231)$_8$ = ( )$_{16}$
        a) (980)$_{16}$
        b) (880)$_{16}$
        c) (899)$_{16}$
        d) A) and c)
32. Convert the following.
    (6879)$_{16}$ = ( )$_8$
    a) (64271)$_8$
    b) (64171)$_8$
    c) (63171)$_8$
    d) None of the above
33. Convert the following base 10 numbers into 8-bit 2's complement notation 0, -1, -12.
    a) 00000000, 11111111, and 11110100
    b) 11110100, 11110100, 11010000
    c) Both a) and b)
    d) None of the above
34. Calculate the following addition using 4 bit unsigned binary addition.
    (11)$_{10}$ + (8)$_{10}$
    a) (10)$_{10}$
    b) (101)$_{10}$

c) $(19)_{10}$
d) $(14)_{10}$

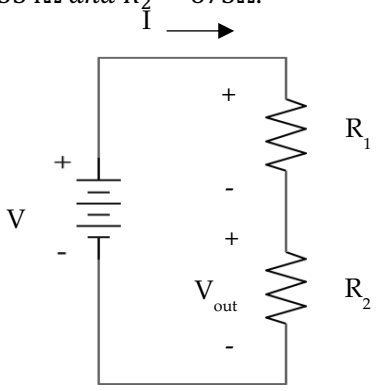
35. Convert the following.
$(1110.1101)_2 = (\ )_8$
a) $(16.00)_8$
b) $(16.64)_8$
c) $(16.21)_8$
d) None of the above

36. Consider the circuit illustrated below. If I_2 = 6mA, what does I_1 equal?
[Hint: Use KCL]
a) 2 mA
b) 1 mA
c) 3 mA
d) 4 mA

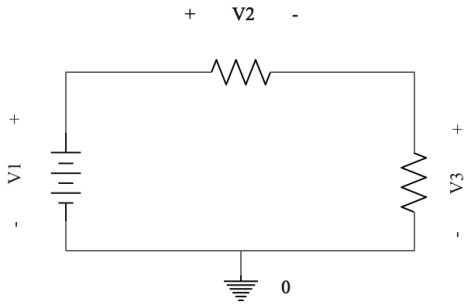


37. Determine the equivalent resistance *Req* of the following three resistors in series: $R1$ = 100 Ω, $R2$ = 100 Ω, $R3$ = 59 Ω. [Hint: $Req = R1 + R2 + \cdots + RN$]
a) 159 Ω
b) 195 Ω
c) 169 Ω
d) 259 Ω

38. Calculate V_{out} from the given circuit, for $V = 12V, R_1 = 1534\Omega \text{ and } R_2 = 673\Omega$.
[Hint: use voltage division rule]
a) 4.9615 V
b) 4.3651 V
c) 3.6592 V
d) 3.4321 V



39. Consider the circuit illustrated below. If V1 = +28V and V2 = +14V, what does V3 equal?
[Hint: Use Kirchhoff's Voltage Law
a) 7 V
b) 11 V
c) 9 V
d) 14 V



40. A circuit has a total resistance of 11 KΩ and a total voltage of 110V. What is the total current in milliamps? Using the result, what is the power in the circuit in milliWatts?
[Hint: V= I*R, P= I*V]

a) 6 mA, 2000mW
b) 8 mA, 1800mW
c) 10 mA, 1100mW
d) 4 mA, 1110mW

41. Two resistors of 12 and 6 ohms are connected in parallel to a 24V battery. What current (in Amps) will be drawn from the battery? [Hint: $R_{eq} = \frac{R_1 R_2}{R_1 + R_2}, I = V/R$]
    a) 6 A
    b) 4 A
    c) 12 A
    d) 8 A
42. When connecting two resistors in series, the resulting resistance is lower than either of the two resistance.
    a) True
    b) False
43. The voltage across a 200 Ohms resistor is 100V. What is the power consumed by that resistor?
    a) 15 W
    b) 25 W
    c) 50 W
    d) 100 W
44. Four 10 ohm resistors are connected in series and in parallel. What is the equivalent resistance for each combination?
    a) 60 Ω, 4.5 Ω
    b) 30 Ω, 2.5 Ω
    c) 40 Ω, 2.5 Ω
    d) 40 Ω, 5 Ω
45. The three resistors of 12 Ω, 48 Ω, and 24 Ω are connected in series with one another. The combination is connected to a 12 V battery whose internal resistance is negligible. What is the total current through the combination?
    a) 1.72 A
    b) 3 A
    c) 0.143 A
    d) 4 A
46. In regression and correlation analysis, the measure whose values are restricted to the range -1 to +1, inclusive, is the,
    a) Coefficient of determination
    b) Slope of regression line
    c) Y intercept of thee regression line
    d) Correlation coefficient
47. The quantity $(Y_i - \widehat{Y})^2$ is called the _____ sum of square.
    a) least
    b) explained
    c) total
    d) Unexplained

48. If, in the regression model, $y = a + bx$, b=0, we say there is _____ relationship between x and y.
    a) An inverse
    b) A significant
    c) A direct
    d) no
49. If, in the regression model $y = a + bx$, b is negative, we say there is _____ linear relationship between X and Y.
    a) An inverse
    b) A significant
    c) A direct
    d) No
50. In the equation $y = a + bx$, 'a' is the
    a) coefficient of determination
    b) slope of the regression line
    c) y intercept of the regression line
    d) correlation coefficient
51. In the equation $y = a + bx$, 'b' is the
    a) coefficient of determination
    b) slope of the regression line
    c) y intercept of the regression line
    d) correlation coefficient
52. The Slope of the straight line is defined as $(y_2 - y_1)$ _____ $(x_2 - x_1)$.
    a) minus
    b) divided by
    c) multiplied by
    d) plus
53. What is the abbreviation for SVM?
    a) Support version margin
    b) Section vector margin
    c) Support vector mask
    d) Support vector machine
54. What is the fundamental idea of SVM for classification?
    a) maximum margin linear classifier
    b) average margin linear classifier
    c) minimum margin linear classifier
    d) max-min margin linear classifier
55. Which of the following statement is false about naïve bayes?
    a) It is developed based on Bayes Theorem
    b) It assumes that all predictors are dependent with each other
    c) It is one classification algorithm
    d) It assumes that all predictors are equally important
56. Computer security deals with
    a. Attacks' detection on the Internet
    b. Policies and strategies for securing local hosts

c. The CIA model
d. None of the above

57. Non-repudiation is a security property that
    a. Ensures that the data being sent will be received without any modifications
    b. Ensures that the data and service are always available
    c. Ensures that no third party can access the data
    d. None of the above
58. A component which aids digital forensics is
    a. OS analysis
    b. Auditability
    c. Application forensics
    d. Network forensics
59. An OSI layer which deals with SSL would be
    a. Application
    b. Physical
    c. Transport
    d. None of the above
60. Internet-wide addressing to route packets from a source to a destination would occur on this TCP/IP layer
    a. Data access
    b. Internet
    c. Network
    d. Transport
61. An OSI layer which deals with application-specific encoding would be
    a. Network
    b. Presentation
    c. Transport
    d. Physical
62. Cyber security does not deal with
    a. Mitigation of attacks
    b. Remediation of vulnerabilities
    c. Inference of attacks
    d. Characterization of attacks
    e. Insider threat detection
    f. None of the above
63. A frame is a typical terminology given to a
    a. Data payload on the data link layer
    b. Data payload with its header and trailer on the physical layer
    c. Data payload with its header and trailer on the data link layer
    d. Data payload on the physical layer
64. TCP is a
    a. Connectionless protocol at the transport layer of the OSI
    b. Connectionless protocol at the transport layer of the TCP/IP
    c. Connection-oriented protocol at the transport layer of the OSI
    d. Connection--oriented protocol at the transport layer of the TCP/IP

65. UDP is often used in
    a. Video chats
    b. Web browsing
    c. File transfer apps
    d. Remote access
66. Which area of study deals with electrical components such as transistors and resistors?
    a. System
    b. Architecture
    c. Device
    d. Circuit
67. In the hierarchy of ECE areas, which is placed below materials and devices?
    a. System
    b. Architecture
    c. Circuit
    d. None of above
68. Materials and Devices is an area of study that is
    a. Located at the bottom of the ECE area hierarchy
    b. The most fundamental
    c. Closely related to physical sciences
    d. All of above
69. Which of the following best describes an organization of materials researchers worldwide?
    a. Materials Research Society (MRS)
    b. Materials Research Organization (MRO)
    c. Institute of Electrical and Electronics Engineers (IEEE)
    d. Electron Devices Society (EDS)
70. Which of the following courses covers the operational principle of micro(nano) devices?
    a. EE4533 Principles of Microfabrication
    b. EE4523 Introduction to Nanoelectronics
    c. EE3213 Electromagnetic Engineering
    d. None of above
71. Which faculty belongs to the area of Materials and Devices?
    a. Amar Bhalla
    b. Ethan Ahn
    c. Youngjoong Joo
    d. All of above
72. What innovations can nanoscale materials and devices can enable?
    a. Haptic feedback sensor
    b. Wireless charging for electric vehicles
    c. Neuromorphic computing hardware
    d. All of above

73. Climate change and global warming are both a hoax—a conspiracy theory to destroy America. True or false?
    a. True.
    b. False.

74. Nuclear power in considered fossil-fuel based and wind turbines can cause cancer.
    a. False and False.
    b. True and False.
    c. False and True.
    d. True and True.
75. How energy efficient are traditional pumped storage hydroelectricity systems?
    a. 65-90% efficient.
    b. 10-20% efficient
    c. 21-40% efficient.
    d. 41-64% efficient.
76. How many BTUs are needed to produce 75 kWh from a fossil fuel power plant?
    a. 69240
    b. 6924000
    c. 6924
    d. 692400
77. What is the percentage of wasted or rejected energy in the US energy economy?
    a. 81-100%
    b. 65-80%
    c. 40-64%
    d. Less than 39%
78. What is the power system stakeholder responsible for ensuring reliable and fair electric power service to all Americans?
    a. Transmission companies.
    b. Electric power utilities.
    c. Independent system operators.
    d. Distribution system operators.
    e. Department of Energy.
79. As an engineer, one should always consider the societal and environmental impact of a product.
    a. True.
    b. False.
    c. Maybe.
80. As engineers, we will be asked at times to make design decisions on what to do, often with information that is incomplete with a future that is uncertain.
    a. True.
    b. False.
81. As professionals, engineers must:
    a. Earn and maintain the public's trust
    b. Fulfill our obligations to the public
    c. Maintain our ethical compass at all times
    d. All of the above
82. Engineers have an ethical obligation to society because engineers design systems and processes that affect the public in many ways.
    a. True.
    b. False.

c. Maybe.

83. Engineers have an obligation to notify their supervisors of any and all situations that put the health and safety of the public at risk.
    a. True.
    b. False.
    c. Maybe.
84. Individual research records are not important because the project manager is responsible for keeping detailed and accurate records to demonstrate the general development of the technology.
    a. True.
    b. False.