

University of Dhaka
 Department of Computer Science & Engineering
 1st Year 2nd Semester B.Sc. in Computer Science & Engineering
 Final Examination, 2011
 CSE -1201: Discrete Mathematics

Total Mark: 60

Time: 2.5 Hours

(Answer any Four (4) of the following Questions)

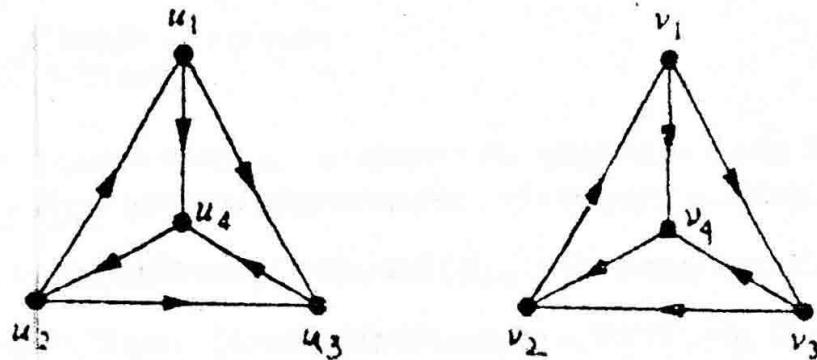
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|----|--|-----|
| 1. | a) Write a partial order relation on the set $A = \{1,2,3\}$. | 1 |
| | b) Consider a set $A = \{1,2,3\}$ and the function f on A defined by
$f = \{(1,2), (2,2), (3,3)\}$. Is the function invertible? | 1 |
| | c) Distinguish between one-one and onto functions. | 2.5 |
| | d) Find cardinal number of the set: $S = \{7, 17, 27, 37, \dots\}$ | 2 |
| | e) Is $x \equiv y \pmod{m}$ an equivalence relation? Prove. | 3 |
| | f) Consider a set $S = \{1,2,3\}$ and the relation R on S defined by
$R = \{(1,1), (1,2), (2,3), (3,2)\}$. Find transitive (R). | 2 |
| | g) Let $A = \{1,2,3,4,5,6,7\}$ and $B = \{4,5,6,8,9,10\}$. Find symmetric difference of A and B . | 1.5 |
| | h) Define partition with an example. | 2 |
| 2. | a) With example define Bi-conditional statement. | 2 |
| | b) Express the following statements using logical connectors and quantifiers. <ul style="list-style-type: none"> i) Everyone in this class has a cellular phone. ii) At least one in this class has a cellular phone. iii) No one in this class has a cellular phone. | 3 |
| | c) Using rules of inferences show that the premises "A student in this class has not read the book." And "Everyone in this class passed the first exam." lead to the conclusion "Someone who passed the first exam has not read the book." | 4 |
| | d) State contrapositive of the implication:
$\text{If it snows today, I will ski tomorrow.}$ | 1 |
| | e) <ul style="list-style-type: none"> i) Translate the statement into a logical expression:
"The summation of two integers is not always positive" ii) Translate the logical statement into English:
$\forall x \forall y (((x \geq 0) \wedge (y < 0)) \rightarrow (x - y > 0))$, where x and y are integers. | 3 |
| | f) Show that $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$ is a tautology. | 2 |
| 3. | a) Solve each linear congruence equation: <ul style="list-style-type: none"> i) $4x \equiv 3 \pmod{7}$ ii) $3x \equiv 3 \pmod{9}$ iii) $33x \equiv 38 \pmod{280}$ | 6.5 |
| | b) Applying CRT find the smallest positive integer x such that when x is divided by 3 it yields a remainder 2, when x is divided by 5 it yields a remainder 4, and when x is divided by 7 it yields a remainder 3. | 3.5 |

- c) Using strong induction prove that if n is an integer greater than 1, then n can be written as product of primes. 2.5
- d) Using mathematical induction prove that $n! < n^n$ where n is an integer greater than 1. 2.5
4. a) Consider the set Q of rational numbers and let $*$ be the operation on Q defined by 4

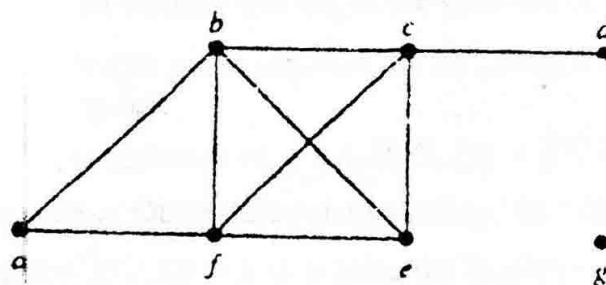
$$a * b = a + b - ab$$
 - i) Find $7 * \frac{1}{2}$
 - ii) Is $(Q, *)$ a semigroup? Is it commutative?
 - iii) Find the identity element.
 - iv) Do any of the elements in Q have an inverse? What is it?
- b) Let $S = N \times N$. Let $*$ be the operation on S defined by $(a, b)* (a', b') = (aa', bb')$ 3
 - i) Show that $*$ is associative.
 - ii) Define $f : (S, *) \rightarrow (Q, \times)$ by $f(a, b) = a/b$. Show that f is a homomorphism.
- c) Consider the group $G = \{1, 2, 3, 4, 5, 6\}$ under multiplication modulo 7. 4
 - i) Find multiplication table of G
 - ii) Find 2^{-1} .
 - iii) Find the orders and subgroup generated by 3.
 - iv) Is G cyclic?
- d) Let σ and τ be the following elements of the symmetric group S_6 : 2
$$\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 1 & 5 & 4 & 6 & 2 \end{pmatrix} \text{ and } \tau = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 5 & 3 & 6 & 1 & 2 & 4 \end{pmatrix}$$

Find $\tau\sigma$ and σ^{-1}
- e) Prove that in a ring R : i) $a \cdot 0 = 0 \cdot a = 0$ and ii) $(-1)a = -a$ 2
 (when R has a identity element 1)
5. a) A man has 11 close friends (male). Two of the friends are not on speaking terms and will not attend together. One of the friends is married and supposed to be invited with his spouse. In how many ways can this man arrange a party of just 6 (excluding himself)? 4
- b) Thirteen people on a softball team show up for a game 2
 - i) How many ways are there to choose 10 players to take the field?
 - ii) Among these 13 people, 3 are women. How many ways are there to choose 10 players if at least one of these players must be a woman.
- c) State generalized pigeonhole principle. At least how many people have the same birthday among 900 people? 2.5
- d) How many different bit strings of length seven start with 1 or ends with 00? 2
- e) How many ways 4 math books, 2 chemistry books and 3 physics books can be arranged on a shelf? How many ways these books can be arranged that all books of the same subject are together? 2.5
- f) Write down the properties of Pascal triangle. .

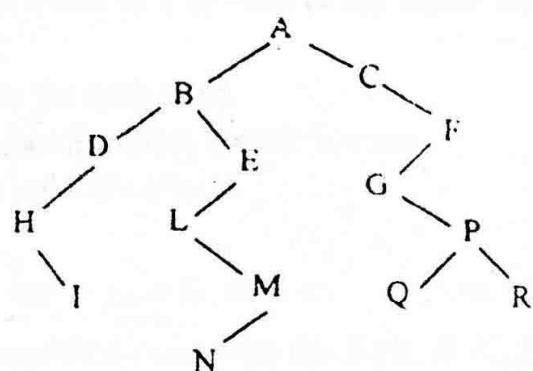
- 6.
- Distinguish between graph and tree.
 - Draw bipartite representation of C_8 .
 - Is $K_{9,10}$ a regular graph?
 - Are the following graphs isomorphic to each other? Prove.



- Find out the chromatic number of the graph G1.



- Store the graph $K_{2,3}$ using linked list.
- Find number of edges of Q_4 .
- Traverse the following tree in inorder way.



University of Dhaka
 Department of Computer Science & Engineering
 1st Year 2nd Semester B.Sc. in Computer Science & Engineering
 Final Examination, 2011
 EEE -1221 : Digital Systems

Total Mark: 60

Time: 2.5 Hours

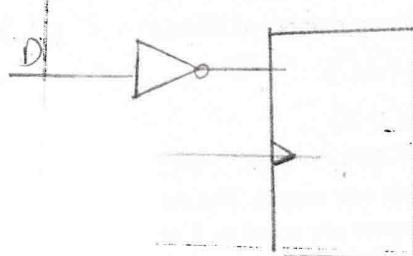
(Answer any Four (4) of the following Questions)

1. a) Convert $(271.A)_{16}$ to the base-2 and base-8 equivalents. 3
- b) How many bits are required to represent the decimal numbers in the range from 0 to 999 using
 - Straight binary code
 - BCD code.
- c) If the digital circuits in a computer only respond to binary numbers, why are octal and hexadecimal numbers used extensively by computer scientists. 3
- d) Perform the additions of $(10)_{10}$ and $(-6)_{10}$ in the binary system. 3
- e) Define BCD code. Mention the advantages of BCD code. The state of a 12-cell register is 010110010111. What is its content if it represents three decimal digits in BCD. 3
2. a) What is the logic which controls a staircase light associated with two switches A and B located at the bottom and top of the staircase respectively? 3
- b) What is EX-OR gate? Mention the advantages of EX-OR gate. Realise EX-OR gate using only NOR gates. 3
- c) Find the complement of $f(A, B, C, D) = \overline{BC} (A \vee CD)$ and reduce it. Obtain the corresponding logic circuit. 2
- d) Prove that $x \vee \overline{x}y = x \vee y$ using the Boolean Algebra. 2
- e) Reduce the following functions to a minimum number of literals: 5
 - $f(A, B, C) = \overline{A} \vee \overline{AB} (A \vee \overline{C} \vee \overline{AC})$
 - $f(A, B, C) = \overline{(A \oplus B)} \vee BC (A \vee B)$
3. a) A combinational circuit has four inputs and one output. The output is equal to 1 when all the inputs are equal to 1 or none of the inputs are equal to 1 or an odd number of inputs are equal to 1. 7
 - Obtain the truth table.
 - Find the simplified output function
 - Draw the logic circuit.
- b) Prove that if $\overline{wx} \vee \overline{yz} = 0$, then $wx \vee \overline{y}(\overline{w} \vee \overline{z}) = wx \vee xz \vee \overline{xz} \vee \overline{w} \overline{yz}$ 4
- c) Obtain the simplified expression for $F(A, B, C, D) = \sum(0, 1, 2, 4, 5, 6, 8, 9, 12, 13, 14)$ 4
4. a) What is Quine-McCluskey method? Mention the advantages of Quine-McCluskey method. Minimize the given combinational single-output function using Quine-McCluskey method.

$$f(w, x, y, z) = \sum_m(0, 1, 5, 8, 10, 14, 15)$$
- b) Give an example such that $F(A, B, C, D) = F(\overline{A}, \overline{B}, \overline{C}, \overline{D})$ 5
- c) Define SOP and POS using examples. Use the karnaugh map to minimize

$$F(A, B, C, D) = \overline{AB} \vee \overline{ABC}\overline{D} \vee AB\overline{CD} \vee \overline{ABCD} \vee ABD \vee \overline{BCD} \vee \overline{ABC}$$

- 5 a) Describe how a D latch operates differently from an edge-triggered D flip-flop. 2
- b) Show how an edge-triggered D flip-flop can be made to operate in the toggle mode. 3
- c) What FF outputs should be connected to the clearing NAND gate to form a MOD-13 counter? 2
- d) What circuit changes will convert a synchronous, binary up counter into a binary down counter? Explain with diagram. 5
- e) Define:
 i) Noise Immunity
 ii) Current-sourcing 3
- a) Distinguish between synchronous and asynchronous counters giving examples. Mention application of each type. 3
- b) What is sample and hold circuit? Design a sample and hold circuit and explain its working principle. 4
- c) Draw the circuit diagram to combine two 16×4 RAM chips to get a 32×4 memory. 6
- d) Distinguish among ROM, PROM, EPROM and EEPROM. 2



University of Dhaka
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 1st Year 2nd Semester B.Sc. in Computer Science & Engineering Final
 Examination, 2011
 STAT-1224 : Introduction to Statistics

Total Marks: 60

Time: 2.5 Hours

(Questions are of equal value. Answer any Four (4) of the following Questions)

1. a) Distinguish between:

- i) Population and sample
- ii) Parameter and statistic
- iii) Discrete variable and continuous variable
- iv) Primary data and secondary data

b) The accompanying table shows the test scores of 50 students:

	16	14	18	27	29	23	33	17	24
26	18	21	11	10	12	13	18	15	16
17	14	15	08	09	17	15	14	10	11
22	13	12	17	16	20	19	10	07	12
10	18	21	19	19	15	09	13	19	18
16									

i) Construct a frequency distribution of the data.

- ii) Use a stem and leaf plot to display the data.
- iii) Draw a histogram and a frequency polygon.
- iv) If top 15% students get the scholarship, then what is the minimum score to get the scholarship?

a) What do you mean by graphical representation? What are the different graphs we use for presenting the statistical data?

b) Define central tendency. How can you compute the arithmetic mean, the median and mode from grouped data? State the advantages and disadvantages of these methods.

c) A sequence takes values $a, ar, ar^2, \dots, ar^{n-1}$ each with unit frequency. Find AM, GM and HM and also show that $AM \times HM = (GM)^2$.

a) What do you mean by dispersion? Define standard deviation and coefficient of variation. Why coefficient of variation is sometimes preferred to standard deviation as a measure of dispersion?

b) If \bar{x} and s denote respectively the mean and standard deviation of a set of n non-negative quantities, then show that $\frac{s}{\bar{x}} \leq \sqrt{n-1}$

c) The following table shows the life of some electric bulb (in hours) of two different companies:

Life of Bulb (in hours)	500-550	550-600	600-650	650-700	700-750
Philips	50	47	30	18	26
Crown	62	34	22	20	12

i) Which company's bulbs have higher average life?

ii) Which company's bulbs are more uniform/stable in their life?

4. a) Define skewness and kurtosis. Discuss their different measures. For any set of observations x_1, x_2, \dots, x_n , prove that $\beta_2 \geq 1 + \beta_1$.

b) Given the following data on the marks obtained by 75 students. Calculate the first four central moments. Also calculate the coefficient of skewness and comment on the shape of the distribution.

Marks(x)	9	12	15	18	21	24	27	30
Number of students (f)	3	7	12	15	18	10	8	2

5. a) Define Pearson's product moment correlation coefficient. State its important properties and uses.
 b) Define scatter diagram. Draw the scatter diagram for $r = 0.67$, $r = -0.12$. Show that the correlation coefficient (r) lies between -1 and +1.
 c) A study was made on the amount of converted sugar in a certain process at various temperatures. The data were recorded as follows:

Temperature, x	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Converted sugar, y.	8.1	7.8	8.5	9.8	9.5	8.9	8.6	9.2	9.3	9.2	9.9

- i) Determine the coefficient of correlation
 ii) Interpret the strength of the correlation coefficient
6. a) What do you mean by simple regression model? State the variables and parameters involved in a simple regression model. Discuss a technique for estimating the parameters of a simple regression model.
 b) Show that the geometric mean of two regression coefficient is same as the correlation coefficient.
 c) From the following data find the value of chi-square:

Job Performance	Educational attainment		
	Primary	Secondary	Higher
Excellent	10	40	10
Good	30	30	20
Fair	10	30	20

Department of Computer Science & Engineering
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 Final Examination, 2011
 MATH -1223 : Linear Algebra

Total Mark: 60

Time: 2.5 Hours

(Answer any Four (4) of the following Questions)

1. a) Define inner product in \mathbb{R}^n and C^n . Prove that $(u, v) = 6u_1v_1 + 2u_2v_2$ is an inner product. 7
 b) When are two vectors orthogonal? What is orthonormal basis? Use Gram Schmidt's process of orthogonalization to transform vectors $\{u_i\}$ into an orthonormal basis $\{v_i\}$, where

$$\{u_1 = \left(\frac{i}{\sqrt{3}}, \frac{i}{\sqrt{3}}, \frac{i}{\sqrt{3}}\right), u_2 = (0, i, 0), u_3 = (0, 0, -i)\}$$
2. a) When is a system of equations consistent? For which values of λ, μ the following system of equations has (i) a unique solution, (ii) no solution, (iii) multiple solution? 8

$$\begin{aligned}x + y + z &= 6 \\x + 2y + 3z &= 10 \\x + 2y + \lambda z &= \mu\end{aligned}$$
- b) Write the augmented matrix for the system of equations: 7

$$\begin{aligned}x + 2y + 3z + t &= 3 \\x + y + z - t &= 5 \\x + y - z + t &= -4 \\x - y + z + t &= 2\end{aligned}$$

 And then reduce the matrix to reduced row echelon form. Hence solve the system.
3. a) Determine which of the following subsets of \mathbb{R}^3 are subspaces of \mathbb{R}^3 . Justify your answer. 7
 i) $S = \{(x, y, z) \in \mathbb{R}^3 : x + y = 2z\}$
 ii) $T = \{(x, y, z) \in \mathbb{R}^3 : x = 0 \text{ or } z = 0\}$
 b) Define linear combination and linear dependence of vectors. Show that $v = t^2 + 4t - 3$ is a linear combination of the polynomials $e_1 = t^2 - 2t + 5$, $e_2 = 2t^2 - 3t$ and $e_3 = t + 3$. 8
4. a) Show that the transformation $T : \mathbb{R}^3 \rightarrow \mathbb{R}^4$ defined by 7
 $T(x, y, z) = (x + y, x + z, x - y, x - z)$ is linear. Find the matrix of T relative to the standard basis.
 b) Let $T : \mathbb{R}^2 \rightarrow \mathbb{R}^3$ be the linear transformation defined by 8
 $T(x_1, x_2) = (x_2, -5x_1 + 13x_2, -7x_1 + 16x_2)$. Find the matrix for T with respect to the bases $B = \{(3, 1), (5, 2)\}$ and $B' = \{(1, 0, -1), (-1, 2, 2), (0, 1, 2)\}$.
5. a) Define the kernel and image of a linear transformation. Let $T : \mathbb{R}^4 \rightarrow \mathbb{R}^3$ be linear transformation defined by $T(x, y, s, t) = (x - y + s + t, x + 2s - t, x + y + 3s - 3t)$. Find a basis and dimension of the (i) kernel of T and (ii) image of T 7
 b) Define transition matrix. Let $E = \{(1, -1), (1, 1)\}$ and $B = \{(1, 2), (-1, 1)\}$ be two bases of \mathbb{R}^2 . Find the transition matrix P from E to B and Q from B to E . 8
6. a) Define eigenvalues and eigenvectors. Find the eigenvalues and corresponding eigenvectors of 7
 the matrix $A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$.
 b) Is the matrix in (a) diagonalizable? If so find an invertible matrix P such that $P^{-1}AP$ is a diagonalizable matrix. 8

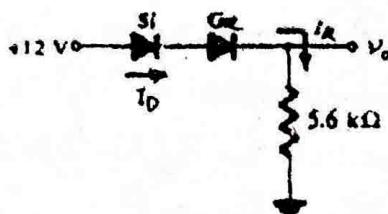
Department of Computer Science & Engineering
 1st Year 2nd Semester B.Sc. in Computer Science & Engineering Final
 Examination, 2011
 EEE-1222 : Basic Electronics

Total Marks: 60

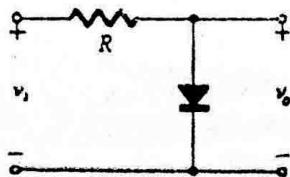
Time: 2.5 Hours

(Answer any Four (4) of the following Questions)

1. a) Why is it possible to convert an intrinsic semiconductor to an extrinsic one? 4
 Discuss with reference to the atomic structure of Si (Silicon).
- b) Define the term 'bandgap'. Distinguish among metal, semiconductor and insulator in terms of their bandgap. 4
- c) Explain the carrier flow across a pn junction when the junction is under reverse bias condition. 4
- d) Determine the output voltage V_0 and I_D for the following circuit where you have a input dc voltage of +12V, two diodes (Si, Ge) and a resistance of 5.6 kΩ. 3

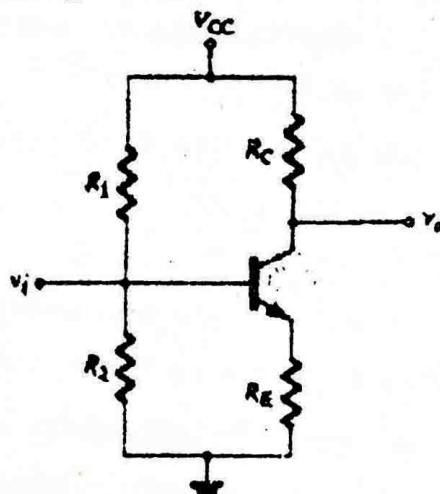


2. a) Explain with figure the operational principle of a tunnel diode. 5
- b) What will be the output waveforms if i) sinusoidal ii) square and iii) triangular waves are given as the input to the following circuit: 3

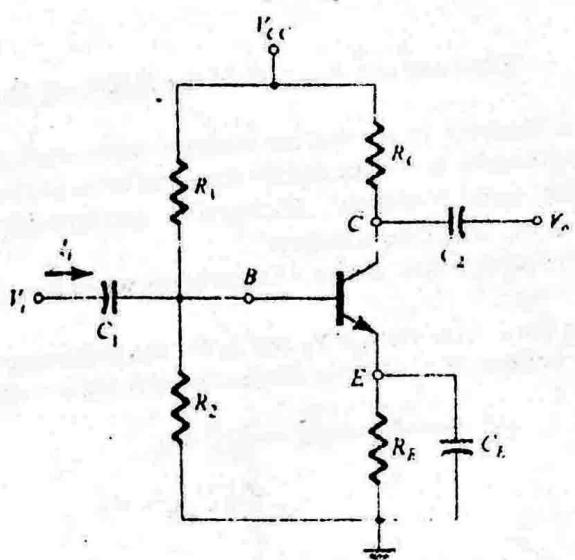


- c) Define the current amplification factor α and β . Show that $\beta = \frac{\alpha}{1-\alpha}$. 2+2
- d) An npn transistor has $I_{CBO} = 0.2 \mu\text{A}$ and $I_{CEO} = 20 \mu\text{A}$. Find the value of α . Calculate I_B when collector current, I_C is 1 mA. 3

3. a) Describe how the input characteristic of CB configuration is determined. Draw the characteristics curve and explain the dependency on different values of output voltage level (V_{CB}). 1+3
- b) Define Q point. Why is DC biasing essential for a BJT to be worked as an amplifier? 1+2
- c) What type of biasing circuit is the following one? Determine the three terminal voltages (V_B , V_C and V_E) and the V_{CE} . Consider $V_{CC} = +18 \text{ V}$, $R_1 = 33 \text{ k}\Omega$, $R_2 = 12 \text{ k}\Omega$, $R_C = 1.2 \text{ k}\Omega$ and $R_E = 1 \text{ k}\Omega$. 5



- d) Draw the AC equivalent of the following circuit and explain why you draw it in 3 this way (Consider V_i as a sinusoidal signal).



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|----|---|-----|
| 4. | a) What is FET? What are the differences between FET and BJT? | 2+3 |
| | b) Give the construction and operation of an n-channel JFET. | 3+3 |
| | c) Sketch the transfer curve defined by $I_{DSS} = 12 \text{ mA}$ and $V_P = -6 \text{ V}$ using Shockley's equation. | 4 |
| 5. | a) What are the advantages of negative feedback? Define CMRR? | 2+2 |
| | b) Draw and explain how an Integrator can be obtained by using OpAmp? | 4 |
| | c) Explain the Barkhausen criterion for oscillation. | 2 |
| | d) Draw and explain the operation of a phase shift oscillator using BJT. | 5 |
| 6. | a) Draw the transistor equivalent circuit of SCR and explain its operation. | 5 |
| | b) Explain how an UJT relaxation oscillator works. | 4 |
| | c) Define ripple factor. Explain how a capacitor filter can be used to reduce the ripple factor. | 1+2 |
| | d) What is diac? How does it differ from a triac? | 2+1 |