

COLLEGE OF ENGINEERING, PUNE
(An autonomous Institute of Government of Maharashtra)

END-SEM Examination

(CT204) Probability and Statistical Inference

Class: - S.Y.B.Tech (Computer Engineering/Information Technology)

Year: - 2010-11
Duration: - 3 hrs.

Semester: - I
Max. Marks: - 50

Instructions:

1. Answer all questions
 2. Figures to right indicate full marks
 3. Draw neat figures wherever required
 4. Assume suitable if necessary
-

- | | Marks |
|---|-------|
| Q1. A) A coin is tossed three times. What is the probability that it lands on heads exactly one time? | 02 |
| B) A box contains 3 blue and 2 red marbles while another box contains 2 blue and 5 red marbles. A marble drawn at random from one of the boxes turns out to be blue. What is the probability that it came from the first box? | 03 |
| C) As accounts manager in your company, you classify 75% of your customers as "good credit" and the rest as "risky credit" depending on their credit rating. Customers in the "risky" category allow their accounts to go overdue 50% of the time on average, whereas those in the "good" category allow their accounts to become overdue only 10% of the time. What percentage of overdue accounts are held by customers in the "risky credit" category? | 03 |

OR

- | | |
|---|----|
| C) Prove that the mean of a binomially distributed random variable is, $\mu=np$ | 03 |
| D) The probability that a contractor will get a contract is '2/3' and the probability that he will get on other contract is 5/9. If the probability of getting at least one contract is 4/5, what is the probability that he will get both the contracts? | 02 |

- Q2. A) Explain the following
1. Discrete Random Variables
 2. Continuous Random Variables

OR

- A) The density function of a random variable X is

$$f(x) = \begin{cases} e^{-x} & x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

03

Find

- a) $E(X)$
- b) $E(X^2)$
- c) $E(X-1)^2$

- B) A continuous random variable X has probability density given by

$$f(x) = \begin{cases} 2e^{-2x} & x > 0 \\ 0 & x \leq 0 \end{cases}$$

03

- 1) Find the variance
- 2) The standard deviation for the random variable

- C) It was found that the mean length of 100 parts produced by a lathe was 20.05 mm with a standard deviation of 0.02 mm. Find the probability that a part selected at random would have a length

04

- (a) between 20.03 mm and 20.08 mm
- (b) between 20.06 mm and 20.07 mm
- (c) less than 20.01 mm
- (d) greater than 20.09 mm.

- Q3. A) An average light bulb manufactured by the Acme Corporation lasts 300 days with a standard deviation of 50 days. Assuming that bulb life is normally distributed, what is the probability that an Acme light bulb will last at most 365 days?

02

- B) Explain the following
1. Point Estimate
 2. Interval Estimate

02

C) What is the sample variance of the following data? 4, 6, 9, 10, 12 and 13

02

D) Find the \bar{x} for the data in the following table using coding method.

04

x	462	480	498	516	534	552	570	588	606	624
f	98	75	56	42	30	21	15	11	6	2

Q4. A) If the standard deviation of the lifetimes of television tubes is estimated as 100 hours, how large a sample we must take in order to be

04

a) 95%

b) 90%

c) 99%

d) 99.73% confident that the error in the estimated mean lifetime will not exceed 20 hours?

B) Suppose an urn contains 30 marbles. Some marbles are red, and the rest are green. Five marbles are randomly selected, with replacement, from the urn. Two of the selected marbles are red, and three are green. Construct an 80% confidence interval for the proportion of red marbles in the urn.

04

OR

B) A sample poll of 100 voters chosen at random from all voters in a given district indicated that 55% of them were in favor of a particular candidate. Find a) 95%, b) 99% confidence limits for the proportion of all voters in favor of this candidate.

04

C) Suppose a simple random sample of 150 students is drawn from a population of 3000 college students. Among sampled students, the average IQ score is 115 with a standard deviation of 10. What is the 99% confidence interval for the students' IQ score?

02

- Q5. A) Explain the following with reference to testing of hypothesis 04
1. Null hypothesis
 2. Level of significance
 3. Type I and Type II Error
 4. Critical region
- B) Design a decision rule to test the hypothesis that a coin is fair if a sample of 64 tosses of the coin is taken and if a level of significance of (a) 0.05 (b) 0.01 is used. 02
- C) The mean height of 50 male students who showed above-average participation in college athletics was 68.2 inches with a standard deviation of 2.5 inches, while 50 male students who showed no interest in such participation had a mean height of 67.5 inches with a standard deviation of 2.8 inches. 04
- a) Test the hypothesis that male students who participate in college athletics are taller than other male students.
 - b) What is the P value of the test?

COLLEGE OF ENGINEERING, PUNE
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Final Examination
CT-214 Programming Methodology

Class – S.Y.B.Tech
Year - 2010-2011
Duration- 3 hrs.

Semester - Autumn
Max Marks -50

Qu1) Explain briefly characteristics of OOPS language and mention advantages of OOPS approach over Functional programming. (6)

Qu2) A program uses a function named convert () in addition to its **main** function. The function main declares a variable x within its body and the function convert() declares two variables y & z within its body, m is made static. A fourth variable m is declared ahead of both the functions. State the visibility and lifetime of each variables.

OR

What are the access control specifiers? Discuss the role of each one of them in inheritance. (3)

Qu3a.) What are the different types of constructors available in C++ ? Write a program that includes at least 4 varieties of constructors in it. (6)

b) How can we achieve run time polymorphism in C++? (4)

Qu.4) Explain Static Scope and Dynamic Scope. (4)

Qu.5) Explain Pure virtual function and friend function with example?

OR

Explain Implicit and Explicit Template Function with example? (4)

Qu.6a.) What is Exception Handling? How is it done? Write a program in C++ that illustrates the exception handling mechanism of C++. (3+3+4)

b.) What is Generic programming? How it is implemented in C++? Explain it in detail with suitable Example. (2+4+4)

Qu.7) Short Note on (any 2) (3)

a) Differences and similarity between Destructor & Constructor

b) Benefits of Procedure

c) Co-routines

d) Control flow for Imperative programming

COLLEGE OF ENGINEERING, PUNE
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End-Semester Examination

CT 202-Digital Systems

Class: -S.Y B.Tech (Computer Engineering/Information Technology)

Year: - 2010-11
Duration: - 3 hrs.

Semester: - I
Max. Marks: - 50

Instructions:

1. Attempt any 5 questions.
2. Figures to right indicate full marks.
3. Draw neat figures wherever required.

23/11/10

Q.1 Explain in detail Random Memory Access and its types with Read / write cycles. 10

OR

Implement the Boolean functions 10

$$F(X,Y,Z) = \sum (1,3,5,6)$$

$$F(A,B,C,D) = \sum (0,1,3,4,8,9,15)$$

with suitable multiplexer in both ideal and reduced form.

Q.2. a) Explain in detail code conversion of BCD to Excess-3 and Binary to Gray. (1+2+2)

b) Perform M-N on M=0100101 and N=1010001 using 1's and 2's complement. 5

OR

Q.3. a) What are Sequential circuits? Explain Master-Slave flip-flop configuration in detail. 5

b) Write short note on Moore & Mealy machines. 5

Q.4. a) Explain in detail the representation of data with different number systems. (2+1+1+1) 5

b) Show conversions for-
1. Decimal to Hex of 140.
2. Decimal 0.6875 to binary.

OR

Q.5. a) Write short note on VHDL Programming. 5

b) Explain Ripple Carry and Carry look ahead adder. 5

Q.6. a) Implement the functions F1 (0, 2, 4,) & F2 (1, 5, 6) with PLA & PAL. 5

b) Write short note on Registers and Counters. 5

OR

Q.7. a) What are data Converters? Explain Successive Approximation A/D technique. 5

b) Write short note on Algorithm State Machine(ASM) 5

Q.8. Implement the following Boolean function with Q-M / Tabulation method- 10

$$F(A,B,C,D) = \sum (0,2,5,6,7,8,10,12,13,14,15)$$

OR

Simplify the Boolean function with Karnaugh Map - 10

$$F(A,B,C,D,E) = \sum (0,2,5,6,9,11,13,15,17,21,25,27,29,31)$$

(2 of 2)

COLLEGE OF ENGINEERING, PUNE
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END SEM EXAM

(CT201) DISCRETE STRUCTURE AND GRAPH THEORY
Class: - S. Y. B. Tech (Computer Engineering/Information Technology)

Year: - 2010-11
Duration: - 3 Hrs

Semester: - III
Max. Marks: - 50

Instructions:

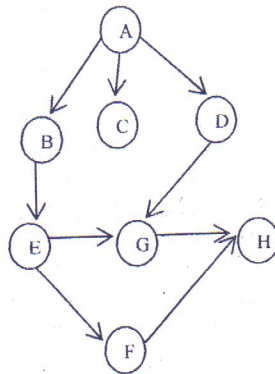
1. Figures to right indicate full marks.
 2. Draw neat diagrams wherever required.
 3. Justify your answers. Answers without proper justification will not get any mark(s).
 4. Write precise answers. Use your judgment while writing proofs/justifications and avoid too short/too long answers (rough guideline is to write at most a full page for four marks).
 5. Write all bits of a question together as far as possible.
 6. Don't leave blank pages/space between answers.
-

- Q.1** Solve any FOUR of the following (each carries TWO marks): **[8]**
- (a)** Write the converse, inverse, contrapositive and negation of the following statement:
If it is holiday today then I will stay at home.
- (b)** Let $F(x, y)$ be the statement " x can fool y " where the domain consists of all people in the world. Express each of the following as a predicate:
1. Everybody can be fooled by somebody
2. Nobody can fool himself/herself
- (c)** Prove by contradiction: $\log_{10}2$ is an irrational number.
- (d)** Prove that at least one of the real numbers a_1, a_2, \dots, a_n is greater than or equal to the average of these numbers. What kind of proof technique did you use?
- (e)** Let A, B, C be arbitrary sets. Under what condition(s) is each of the following statement true?
1. $(A-B) \cup (A-C) = A$
2. $(A-B) \cup (A-C) = \emptyset$
- Q.2** Solve any THREE of the following (each carries THREE marks): **[9]**
- (a)** How many numbers must be chosen from the integers 10, 11, 12, ... 97, 98, 99 so that
1. At least a multiple of 3 is included in the selection?
2. Two numbers with the same first (most significant digit) are included in the selection?
3. Two numbers with at least one digit in common (for example, 12 and 52, 12 and 25) are included in the selection?
- (b)** Let $A = \{1, 2, 3, 6, 9, 18\}$ and R is a relation on A such that $R = \{(x, y) \mid x \in A, y \in A \text{ and } x \text{ divides } y\}$.
1. Draw the Hasse diagram for the poset (A, R) .
2. List maximal and minimal elements of the poset (A, R) .
3. Give the elements in a longest chain and a longest antichain in the poset (A, R) .

- (c) Find the domain and range for each of the function described below:
1. The function that assigns to each nonnegative integer its last digit
 2. The function that assigns to each whole number ($\dots, -2, -1, 0, 1, 2, \dots$) the number of ones ('1's) in its binary representation (e.g. 5 will be assigned 2 as 101 has two 1s)
 3. The function that assigns to each positive integer the largest perfect square not exceeding this integer
- (d) What is an onto (surjection) function? If f and $(f \circ g)$ (composition of f and g) are onto functions, does it follow that g is onto? Justify your answer.

- Q. 3 Solve any THREE of the following (each carries THREE marks):
- (a) Apply BFS algorithm to the following graph with the starting vertex as A:

[9]



- (b) Consider the fish of types A, B, C, D, E, F. There is a rule to keep them in fish tank as follows –

Fish Type →	A	B	C	D	E	F
Cannot be with Type →	B,C	A,C,E	A,B,D,E	C,F	B,C,F	D,E

What is the minimum number of fish tanks that are required to keep the fish such that the rule is satisfied?

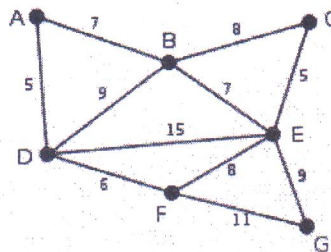
- (c) Show that any simple (without self loops) graph with two or more vertices has at least two vertices of the same degree.
- (d) The complementary graph G' of a simple graph G has the same vertices as G . Two vertices are adjacent in G' if and only if they are NOT adjacent in G . If G is a simple graph with 15 edges and G' has 13 edges, how many vertices does G have?

- Q. 4 Solve any FOUR of the following (each carries THREE marks):

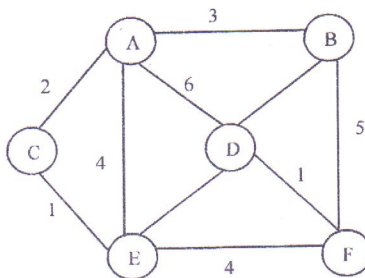
[12]

- (a) Let L be a circuit in a graph G . Let a and b be any two edges in L . Prove that there exists a cut-set C such that $L \cap C = \{a, b\}$.
- (b) Construct an optimal binary prefix code for the set of weights = $\{1, 2, 4, 5, 6, 9, 10, 12\}$. For each weight in the set, give the corresponding code word.
- (c) A chain letter starts when a person sends a letter to five others. Each person who receives the letter either sends it to five other people who have never received it or does not send it to anyone. Suppose that 10,000 people send out the letter before the chain ends and that no one receives more than one letter. How many people receive the letter and how many do not send it out?

- (d) Find the minimum spanning tree using Prim's or Kruskal's algorithm for the graph shown below. State the algorithm you plan to use first and then give the solution.



- (e) Find shortest distances of all vertices from **A** using Dijkstra's shortest path algorithm.



Q. 5

Solve any FOUR of the following (each carries THREE marks):

[12]

- (a) Assume that the population of the world in 2002 was 6.2 billion and is growing at the rate of 1.3% a year.
- Set up a recurrence relation for the population of the world n years after 2002.
 - Find an explicit formula for the population of the world n years after 2002.
 - What will be the population of the world in 2022?
- (b) Consider the multiplication of bacteria in a controlled environment. Let a_r denote the number of bacteria there are on r^{th} day. We define the rate of growth on the r^{th} day to be $a_r - 2a_{r-1}$. If it is known that the rate of growth doubles every day, determine a_r given that $a_0 = 1$.
- (c) Let a_n be the sum of the first n perfect squares, that is

$$a_n = \sum_{k=1}^n k^2$$

Show that the sequence $\{a_n\}$ satisfies the recurrence relation $a_n = a_{n-1} + n^2$ with initial condition $a_1 = 1$. Solve the recurrence relation to get a formula for a_n .

- (d) Let $(A, *)$ be a semigroup. Furthermore, for every a and b in A , if $a \neq b$ then $a*b \neq b*a$. Therefore, $a*b = b*a$ implies $a = b$.
- Show that for every a in A ,
 $a*a = a$
 - Show that for every a, b in A
 $a * b * a = a$
 - Show that for every a, b, c in A ,
 $a * b * c = a * c$

- (e) Define **Ring** as an algebraic system. Give an example of a ring and show that how it satisfies the conditions given in the definition.

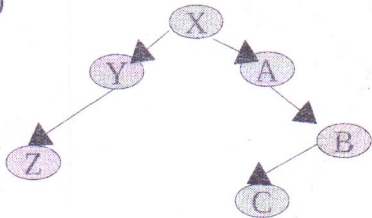
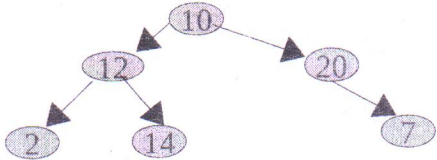
College of Engineering, Pune
END SEMESTER EXAM Nov. 2010
S.Y. Computer Engineering and Information Technology
(CT-203)- (Data Structures and Algorithms)

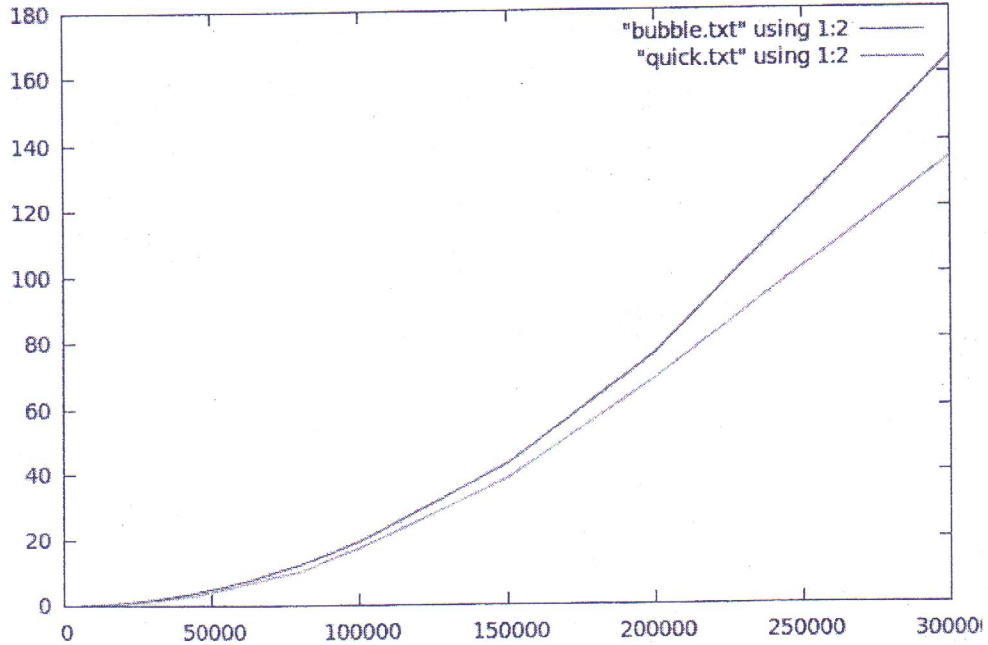
Max. Marks – 100

Duration - 3 Hours

Instructions:

1. Code must be indented, commented and written in ANSI C.
2. Write relevant declarations of data structures for every function/program, if not already given.
3. Write the assumptions that you may make.
4. This is an open book exam. You can carry upto 2 textbooks with you.
5. All questions are compulsory. Write precise answers.
6. Total marks will be converted to out of 50.

		Marks
Q. 1	A	10 [2 each]
<p>Draw a diagram/illustration for each of the following (don't draw intermediate stages, just draw the final diagram):</p> <p>a) A dynamic implementation queue, with elements inserted in following order: 15 23 18 9</p> <p>b) An array based stack of size 8 (with top initialized to 0) after following operations: push(9), push(7), push(5), pop()</p> <p>c) A binary search tree with elements inserted in following order: "abc", "aa", "mno", "stuv", "zy"</p> <p>d) Various states of the following sequence of numbers, with each iteration of min-selection sort (just write the sequence after each iteration of outer loop) 4 2 9 6</p> <p>e) A hash table with 9 buckets, hash function given below and after insertions of following elements : 11, 3, 5</p> <pre>int hash(int data) { return data % 9; }</pre>		
	B	4
<p>Write the iterative binary search function <pre>int binary(int a[], int l, int h, int x);</pre> and comment on it's worst case time complexity.</p>		
	C	6
<p>Write the inorder, preorder and postorder traversals of the following binary trees:</p> <p>a) </p> <p>b) </p>		
Q. 2	A	5
<p>Using the type definition</p> <pre>typedef struct node { float f; struct node *next; }node; typedef struct node *ll;</pre> <p>Write a recursive function for to create a copy of a singly linked NULL terminated dynamic list.</p> <pre>ll copy(ll l);</pre>		

	<p>B Write a recursive function to create a mirror of a given tree, using following type definitions.</p> <pre>typedef struct node { int val; struct node *left, *right; }node; typedef struct node *tree; tree mirror(tree t); // prototype of the function to be written.</pre>	5																								
	<p>C Given an integer linked list data type with following functions:</p> <pre>typedef ... something ... ll; void insert(ll *l, int val, int pos); int remove(ll *l, int pos); void init(ll *l);</pre> <p>Write implementation of a stack data type with following functions(write a type definition for stack and code for following functinos).</p> <pre>void sinit(stack *s); void push(stack *s, int val); int pop(stack *s);</pre>	5																								
	<p>D Using the type definition given in sub-question (A) above, write a function for inserting a node at a given position in a singly linked list.</p> <pre>void insert(ll *l, int val, int pos);</pre>	5																								
		Marks																								
Q. 3	<p>A Implement a character queue using dynamically allocated array, which grows in size on demand. (Just write the queue functions and type definition).</p>	8																								
	<p>B Given below is a graph of comparison of performance of quicksort and bubblesort. The X axis is size of the input data, and Y axis represents the time taken by each algorithm. The line above another represents bubble sort.</p>  <table border="1"> <caption>Approximate data points from the graph</caption> <thead> <tr> <th>Input Size (X-axis)</th> <th>Time for quick.txt (Y-axis)</th> <th>Time for bubble.txt (Y-axis)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>50,000</td> <td>~5</td> <td>~10</td> </tr> <tr> <td>100,000</td> <td>~15</td> <td>~30</td> </tr> <tr> <td>150,000</td> <td>~35</td> <td>~60</td> </tr> <tr> <td>200,000</td> <td>~70</td> <td>~110</td> </tr> <tr> <td>250,000</td> <td>~110</td> <td>~160</td> </tr> <tr> <td>300,000</td> <td>~140</td> <td>~190</td> </tr> </tbody> </table> <p>Analyse whether the performance seen is the same as theoretical time complexities. If it is not, then write possible reasons for the discrepancy.</p>	Input Size (X-axis)	Time for quick.txt (Y-axis)	Time for bubble.txt (Y-axis)	0	0	0	50,000	~5	~10	100,000	~15	~30	150,000	~35	~60	200,000	~70	~110	250,000	~110	~160	300,000	~140	~190	6
Input Size (X-axis)	Time for quick.txt (Y-axis)	Time for bubble.txt (Y-axis)																								
0	0	0																								
50,000	~5	~10																								
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150,000	~35	~60																								
200,000	~70	~110																								
250,000	~110	~160																								
300,000	~140	~190																								

			Marks
	C	<p>Write true or false with reasoning</p> <p>a) Worst case time complexity of search on a Binary Search Tree is $O(n)$ where n is the number of nodes.</p> <p>b) Mergesort is the best sorting algorithm in <i>all</i> respects.</p> <p>c) Dynamic singly linked implementation of a list is <i>always</i> worse than the doubly linked implementation.</p>	6 [2 each]
Q. 4	A	<p>Write a function to compute x raised to power y, where x and y are both integers. Your function should have $O(\lg n)$ worst case time complexity.</p>	5
	B	<p>Write an implementation of a queue using an array. The queue should shift all its elements on an dequeue(), and the dequeue should always happen at the 0^{th} index of the array. (No need to write any code for using the queue functions, just write the queue functions and type definition)</p>	5
	C	<p>Using the type definition given below</p> <pre>typedef struct node { char val; struct node *next, *prev; }node; typedef struct ll { node *head, *tail; }ll; Write following functions for a dynamic doubly linked NULL terminated list</pre> <p>void init (ll *l); // initialize the list</p> <p>int empty(ll l); // tell whether the list is empty</p> <p>int length(ll l); // return the no. of elements in list</p> <p>void reverse(ll *l); // reverse the list in-situ</p>	1 1 3 5
Q. 5	A	<p>Implement a hashing scheme where on a hash collision for storing data, elements are searched in a linear fashion. You should write the hash function, a function for storing data with a separate function for collision resolution. Assume the data to be integers. You may assume any other data structures needed for the same.</p> <pre>int hash (int data); // the hash function /* function to return index for storing/retrieving data */ int getlocation(int data); int storedata(int data); // function to store the data int search(int data); // returns location of data</pre>	5
	B	<p>Write a complete program that reads a file containing a set of records given below, and writes back in the same file only those records which have age ≥ 18. The filename will be specified as an argument on the command line. The number of such records in the file is not known beforehand.</p> <pre>typedef struct record { int age; char name[16]; }record;</pre>	5

		Marks
C	<p>For dynamic implementation of sparse matrices write a function to check whether the matrix is symmetric or not. Given following data structure declarations:</p> <pre>typedef struct node { int val; int row, col; struct node *rptr, *cptr; }node; typedef struct spmat { node *rows[100], *cols[100]; int nrow, ncol; }sparse_matrix;</pre> <p>Where: a <i>node</i> contains one element of the matrix. Each <i>node</i> is linked on a singly-linked NULL terminated list through <i>rptr</i> starting at <i>rows[i]</i> array element (i is some integer). Each node is similarly linked on the <i>cptr</i> starting at <i>cols[j]</i> array element (j is some integer). <i>nrow</i> and <i>ncol</i> are the actual number of rows and columns of the matrix.</p> <p>function prototype: <code>int issymmetric(sparse_matrix *m);</code></p>	10