Final Examination

Due: In 120 minutes.

Course: CSci 5180 Winter 94.

Instructions:

1. There are six questions in this paper. Questions 1 has four parts. Question 2 has 3 parts. Question 3 has 2 parts. Question 4 has 2 parts. Question 5 has 2 parts. Question 6 has 2 parts. Please use the space provided (below the questions) to write the answers. Please use the space at the back of the papers to carry out your intermediate computations.
2. Budget your time to answer various questions to avoid spending too much time on a particular question. Some question include a lot of text, which need not be studied in detail to answer the question.
3. It is an open text-book, open notes examination. Please do not use any other book.

NAME:	
UMN Identification Number:	
Account:	
Machine:	
Classification:	day / extension / NTU / UNITE

Score Table	
Question	Score
Q1a	
Q1b	
Q1c	
Q1d	
Q2a	
Q2b	
Q3a	
Q3b	
Q4a	
Q4b	
Q5a	
Q5b	
Q6a	
Q6b	

Q1. Consider the PROCEDURE TRIANGLE and the set of test-cases given below:

```
PROCEDURE TRIANGLE(A, B, C: integer);
begin
 WRITE(' Provide lengths of 3 sides: '); READ(A, B, C);
 If ((A > 0) and (B > 0) and (c > 0))
 Then If ( ((A+B) > C) and ((B+C) > A) and ((C+A) > B) )
       Then  if (A = B) Then If (B = C) Then WRITE ( 'Equilateral') Else WRITE ( 'Isosceles: A=B' )
             Else If (B = C) Then WRITE ( 'Isosceles: B=C' )
                   Else If (A = C) Then WRITE ( 'Isosceles: A=C') Else WRITE ( 'Scalene' )
       Else WRITE( 'Not a triangle' )
 Else WRITE ( 'Invalid input');
end;
```

Input	Test cases T1, T2, ..., T14 for Triangle Procedure													
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
A	4	999	1	-1	1.9	1	2	1	1	1	1	2	1	1
B	1	999	3	1	1	1	1	2	1	-1	1.9	3	1	1
C	4	1	3	4	4	2	1	1	1	4	4	4	-999	0.99

Q1a. (5 points)

Does the given set of test-cases satisfy statement coverage criteria? Justify your answer by providing a test-case for statement by filling in following table.

Statement	Test-case	Statement	Test-case
WRITE('Equilateral')		WRITE('Isosceles: B=C')	
WRITE('Isosceles: A=B')		WRITE('Isosceles: A=C')	
WRITE('Scalene')		WRITE('Not a Triangle')	
WRITE('Invalid Input')		READ(A, B, C)	

Q1b. (5 points)

Does the given set of test-cases satisfy condition coverage criteria? Justify your answer by providing a test-case to make the condition true and another to make the condition false by filling in the following table:

Simple Condition C =	A > 0	B > 0	C > 0	A+B > C	B+C > A	C+A > B	A =B	B = C	C = A
Test-case s.t. C = True									
Test-case s.t. C = False									

Q1c. (5 points)

Does the given set of test-cases satisfy path coverage criteria? Justify your answer.

Q1d. (5 points)

Consider black-box testing techniques based on boundary values. Identify domains and boundary values for the PROCEDURE TRIANGLE. Suggest 4 new test-cases to test the boundary conditions.

Q2. Compare and contrast the following pair of concepts. by defining each concept and noting the similarity the differences:

Q2a. (5 points)
Prototype vs. Version

Q2b. (5 points)
Inspection and Walk-through

Q2c. (5 points)
Object oriented Design and Structured Design

Q3a. (5 points)

Can correctness proving solve the problem that the product as delivered to the customer may not be what the client really needs? Give reasons for your answer.

Q3b. (5 points)

Consider the following code fragment:

```
J := 0;
F := 1;

/* <condition 1> */

While (J < N) loop
        J := J + 1;
        F := F * I;
end loop;

/* Comment: <condition 2> */
```

Assume that the correctness post-condition (<condition 2>) states that this code correctly computes factorial(N), if N is a positive integer.

Formally specify the post-condition (i.e. <condition 2>), the pre-condition (i.e. <condition 1>) and loop-invariant to show the correctness of this program segment.

Q4a. (5 points)

Suppose you have to write a product-driver about 250 lines long to check that the root (i.e. solution) of a specific equation has been correctly computed. When the product has been written and tested, the product-driver will be thrown away. What life-cycle model will you use to develop the product-driver? Justify your answer.

Q4b. (5 points)

Consider the case study of software development for the Pharmacy of Ms. Ehree Hospital. What life-cycle model was followed in the homeworks? Would rapid prototyping be a better choice if you encountered the same situation in real-life? Justify your answer.

Q5. Consider the following change management procedure.

User sends the project manager and owner a change request form specifying project#, project name, reason for request, class of change (emergency, mandated, enhanced, other) and category of change (requirement, design, code, interface, other). Project manager and software engineer develop an impact statement. At this time, the project manager's check list is used to identify all work actions and changes relating to the request. The impact statement includes project#, project name, request#, a list of impacts with estimated cost and effort. The change request is discussed with the user/owner to establish priority, schedule and cost changes. Agreement is formalized and user/owner approval of schedule and cost is obtained. Using the impact statement, application and all related documents are changed. Changes to software are implemented. As tasks are completed, project manager checks off the tasks from his/her check-list. The request, expected and actual dates of action, schedule changes, cost changes are added to project history file. Finally, user/owner approval to close the request is obtained and the request is closed.

Periodically, cost and volume of changes are tracked through the change control process. Summary reports by project of the changes over a given period, or comparing periods are developed.

Q5a. (5 points)

Draw a organizational data-flow diagram to represent the change control process. You may use non-software processes in your diagram. Limit the diagram to level 1 DFD with at most 5 processes.

Q5b. (5 points)

Is this procedure useful for a software company developing products like WINDOWS or Unix for a large market of consumers? Justify your answer.

Q6. Consider the following problem concerning the specification of the control logic to move elevators between floors according to the specified constraints. An elevator is to be installed in a building with 2 floors. The elevator has two buttons, one for each floor. They illuminate when pressed and cause the elevator to visit the corresponding floor. The illumination is cancelled when the corresponding floor is visited by the elevator. Each floor has a button to request the elevator. These buttons illuminate when pressed. The illumination is cancelled when an elevator visits the floor and moves in the desired direction. When the elevator has no request to service, it should remain at its current floor with its doors closed.

Q6a. (5 points)

Buttons, elevator buttons and floor buttons are three useful classes of object in a object oriented decomposition of this system. Identify three other useful classes of objects to model this system.

Q6b. (5 points)

For each of the three new classes and the buttons class, identify two operations, which are useful in object-oriented modeling of the system.