Vrije Universiteit, Department of Computer Science

Examination paper for **Software Testing**
15 June 2007 12:00-14:45

This is a closed book written exam.

No printed material or electronic devices are admitted for use during the exam.

The answers have to be given in English or Dutch.

Both homework and exam are compulsory and graded on a 1 to 10 scale.

The exam grade is calculated as (Q1+Q2+...+Q5+10)/10.

The final grade is calculated as 0.4*homework + 0.6*exam

A pass is given if both components as well as the final grade are >= 5.5.

	Q1	Q2	Q3	Q4	Q5					ΣQi	Maximum credits= (ΣQi+10)/10
a)	3	5		3							
b)	3	5		2							
c)	3	5		10							
d)	3	5		5							
e)	3			10							
Total	15	20	15	30	10					90	10

Good luck!

Q1 [15p] Define the following terms and in each case give an example.

a) The bug life cycle [3p]
b) On/Off point in domain testing [3p]
c) Equivalent mutant [3p]
d) Software reliability models [3p]
e) Definition-clear path [3p]

Q2 [20p]

a) Define verification and validation and explain their place in the testing process V-model. [5p]

b) Define statement and decision coverage test adequacy criteria. Give an example of fault that cannot be detected by 100% statement coverage testing. [5 p]

c) Explain shortly the state transition diagram testing method. Give an example of a state transition diagram and show its recommended test cases. [5 p]

d) Describe the inspection process and the resulting documents. [5p]

Q3. Black-box testing [15p]

Consider the following scenario used by a marketing company to test its products on the market:

The customers are treated according to 3 characteristics: Gender (male/female), City Dweller (Y/N) and Age group: A (young-under 30), B (middle-aged, between 30 and 60) and C (old, over 60.

The company has 4 products (W, X, Y and Z) to test on the market. Product W will appeal to female city dwellers. Product X will appeal to young females. Product Y will appeal to male middle-aged shoppers who do not live in cities. Product Z will appeal to all clients except older females.

Suggest a black-box procedure to test the software module used to decide which products should be evaluated by each customer. Argument your choice and generate the test cases.

Q4. White-Box testing [30p]

Consider this Java implementation of the triangle problem.

```
public class Triangle {


static int INVALID_TRIANGLE = 1 ;
static int SCALENE_TRIANGLE = 2;
static int ISOSCELES_TRIANGLE = 3 ;
static int EQUILATERAL_TRIANGLE = 4 ;


public static int get_Type(int a, int b, int c)

{
      int type;
      if (a>b)
            {int t = a; a = b; b = t;}
      if (a>c)
            {int t = b; b = c;c = t;}
      if (b>c)
            {int t = b;b = c;c = t;}

      if (a+b <= c) type= INVALID_TRIANGLE;
      else {
            type = SCALENE_TRIANGLE;
            if (a ==b && b==c)
                  type = EQUILATERAL_TRIANGLE;
            else if (a==b || b==c)
                  type = ISOSCELES_TRIANGLE;
            }

            return (type);
}


}
```

a) [3p] Draw a control flow-graph for the above module
b) [2p] Determine the McCabe complexity
c) [10p] Prepare suitable test cases using the basis-path testing technique.

d) [5p] Implement these test cases in a unit test for JUnit frameworks.

e) [10p] Generate 3 mutants of this Java class. Test these mutants with the test suite from section c). Which of the mutants will stay alive? What can you say about the quality of your test suite?

Q5. Article [10p] For homework assignment 5 you had to review a scientific article. Explain what was according to you the author's main message. What is your own opinion in this matter?