Vrije Universiteit, Department of Computer Science

Examination paper for **Software Testing**
28 May 2008 8:45-11:30

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+...+Q6+10)/10.

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

A pass is given if both homework and exam components are >= 5.5.

	Q1	Q2	Q3	Q4	Q5	Q6				ΣQi	Maximum credits= (ΣQi+10)/10
a)	3	5		3							
b)	3	3		5							
c)	3	5		5	5						
d)	3	5		5	2						
e)	3	5									
f)		5									
Total	15	28	15	18	7	7				90	10

Good luck!

Q1. Short answers [15p]

Define the following terms and give in each case an example.

a) Test adequacy criterion [3p]

b) ON and OFF points [3p]

c) Definition-clear path [3p]

e) Verification and validation [3p]

f) Dynamic software reliability model [3p]

Q2 Long answers [28p]

a) Explain the orthogonal arrays testing technique. How does it work and in what situations can it be applied? [5p]

b) What are the two goals of fault based testing? [3p]

c) What is Watir and how does it work? [5p]

d) Define test driven development and give one advantage and one disadvantage. [5p]

e) Enumerate 6 metrics that can be used to decide when to stop testing. [5p]

f) Who can be in your opinion regarded as morally responsible for the Therac accident? Explain your answer. [5p]

Q3. Black-box testing [15p]

A software module is used by a bookshop in calculating the shipping charges. The bookshop is using the following rates:

For orders less than $250.00 :

If the number of items is 3 or less:

Delivery type	Shipping charge
1 day	$35.00
2 day	$15.00
Standard	$10.00

If the number of items is 4 or more:

Delivery type	Shipping charge
1 day	$7.50 per item
2 day	$3.50 per item
Standard	$2.50 per item

For order over $250:

If the number of items is 3 or less:

Delivery type	Shipping charge
1 day	$25.00
2 day	$10.00
Standard	$1.50 per item

If the number of items is 4 or more:

Delivery type	Shipping charge
1 day	$6.00 per item
2 day	$2.50 per item
Standard	free

Generate all the test cases needed to test this module by using decision table testing by contract.

Q4. White-Box testing [18p]

Given the following Java method to collapse adjacent newline characters, taken from the Apache project:

```java
public static String collapseNewlines (String argStr)
        {
        char last = argStr.charAt(0);
        StringBuffer argBuf = new StringBuffer();

        for (int cldx = 0; cldx < argStr.length();cldx++)
        {
                char ch=argStr.charAt(cldx);
                if(ch != '\n' || last != '\n')
                {
                        argBuf.append(ch);
                        last=ch;
                }
        }
        return argBuf.toString();
        }
```

a) Draw its control flow graph [3p]
b) Generate test cases for 100% statement coverage. [5p]
c) Extend the test cases from b) to achieve 100% decision coverage.[5p]
d) Write Junit test case for all the test suite generated in c). [5]

Q5. Mutation testing [7p]

This Java method will return the sum of the even value elements of a one dimensional array:

```java
static int sumEvenArray(int[] array)
        {
        int sum = 0;
        for (int i = 0; i < array.length; i++)
        {
                if (array[i] % 2 == 0)
                {
                        sum += array[i];
                }
        }
        return sum;
        }
```

Consider this test case: input array {1,4,6,7} and expected output: 10

a) Generate a mutant that will be killed by the test case and one mutant that will not be killed. [5p]

b) Show a mutant that can never be killed [2p]

Q6. Article [7p] 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?