

Vrije Universiteit, Department of Computer Science

Examination paper for **Software Testing**

26 August 2008 08.45-11.30 KC 159

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 $(Q1+Q2+\dots+Q6+10)/10$.

The final grade is calculated as $0.4 \cdot \text{homework} + 0.6 \cdot \text{exam}$

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

	Q1	Q2	Q3	Q4	Q5	Q6				ΣQi	Maximum credits= $(\Sigma Qi+10)/10$
a)	3	5		3							
b)	3	5		5							
c)	3	5		5	2						
d)	3	5		5	3						
e)	3	5									
f)		5									
Total	15	30	15	18	5	7				90	10

Good luck!

Q1. Short answers [15p]

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

- a) Regression testing [3p]
- b) Definition-clear path [3p]
- c) Model based testing [3p]
- d) Mutation operator [3p]
- e) Oracle [3p]

Q2 Long answers [30p]

- a) Explain domain testing technique. How does it work and in what situations can it be applied? [5p]
- b) Define verification and validation and explain their place in the testing process V- model. [5p]
- c) What is the Rayleigh model and how it can be used in software testing? [5p].
- d) Describe test driven development and give one advantage and one disadvantage. [5p]
- e) Enumerate 5 factors that can influence the choice of a certain technique in functional testing. Argument your answer. [5p]
- f) Summarize the discussion in Birch's article "Moral responsibility for harm". Who was seen as morally responsible in Therac -25 accident and what were the conclusions? What is your opinion? [5p]

Q3. Black-box testing [15p]

Consider the following software requirements:

GMC writes mortgage loans for people wishing to purchase a new home and applies the following mortgage lending policy: only people with incomes between \$1000/month and \$85.000/month can apply. The number of items can be one to five houses. Only persons can apply for a mortgage, not corporations, trusts, partnerships or other types of legal entity. Mortgages are issued only for condominiums, townhouses and single family dwellings, not for mobile homes, duplexes, etc.

Generate test cases for a defensive testing using equivalence classes testing.

Q4. White-Box testing [18p]

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

```
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();
}
```

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

Q5. Mutation testing [4p]

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

```
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 this test case. [2p]
- b) Show a mutant that can never be killed [3p]

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?