Prof. Dr.-Ing. Peter Liggesmeyer   TU Kaiserslautern
Dipl.-Inf. Max Steiner   Dept. of Computer Science
                                                    AG Software Engineering: Dependability

Software Quality Assurance (WS14/15)

Problem Set 2

Due: in exercise, 26.11.2014

Problem 1:   Quality Assurance Methods

Please define the categories of quality assurance methods.
What is the major difference between "informal methods" and "formal methods"?

Problem 2:   Test Phase

Please explain the test phases according to their necessities and benefits. Please depict these phases considering an object-oriented software development.

Problem 3:   Test Methods

Please illustrate the main differences between dynamic test, static analysis, and formal methods. Please point out their respective advantages and drawbacks.

Problem 4:   Control Flow Testing

Given is a function ALL_POSITIVE implemented in Java, which examines all elements of a one-dimensional field of simple integers to see whether these are bigger than 0.

```java
boolean ALL_POSITIVE(int[] array) {
  boolean result;
  int i,len,tmp;
  len = array.length;
  i=0;
  result=true;
  while (i<len&&result) {
    tmp=array[i];
    if (tmp<=0)
      result=false;
    i++;
  }
  return result;
}
```

   a) Please plot the control flow diagram for the ALL_POSITIVE function.
   b) Please find a minimal necessary test case for achieving the statement coverage of the operation ALL_POSITIVE.
   c) Please determine a minimal necessary test case for fulfilling the branch coverage of the operation ALL_POSITIVE.

Problem 5: Condition Coverage

Given is this section from a Java source code.

```
    ...
if ((a<0&&b>0)||(c==0&&d!=0))
    ...
```

a) Please find out the minimal set of necessary logical value combinations for fulfilling the **simple condition coverage** for the complete evaluation of the partial decisions and for the incomplete evaluation of the partial decisions from left to right. Please determine the corresponding test data for each logical value combination that would lead to the appropriate logical values.

Complete Evaluation

	A	B	C	D	
	a<0	b>0	c==0	d!=0	Total

Incomplete Evaluation from left to right

	A	B	C	D	
	a<0	b>0	c==0	d!=0	Total

b) Please find out the minimal set of necessary logical value combinations for fulfilling the **multiple condition coverage** for the complete evaluation of the partial decisions and for the incomplete evaluation of the partial decisions from left to right. Please state how many test cases are needed as a minimum for the complete evaluation. Please determine the corresponding test data for each logical value combination that would lead to the appropriate logical values.

Complete Evaluation

	A	B	C	D	
	a<0	b>0	c==0	d!=0	Total

Incomplete Evaluation from left to right

	A	B	C	D	
	$a<0$	$b>0$	$c==0$	$d!=0$	*Total*

c) Please find out the minimal set of necessary logical value combinations for fulfilling the **minimal multiple condition coverage** for the complete evaluation of the partial decisions and for the incomplete evaluation of the partial decisions from left to right. Please determine the corresponding test data for each logical value combination that would lead to the appropriate logical values.

Complete Evaluation

	A	B	C	D	E	F	Total
	a<0	b>0	c==0	d!=0	A&&B	C&&D	E||F

Incomplete Evaluation from left to right

	A	B	C	D	E	F	Total
	a<0	b>0	c==0	d!=0	A&&B	C&&D	E||F

d) Please find out the minimal set of necessary logical value combinations for fulfilling the **modified condition decision coverage** for the complete evaluation of the partial decisions and for the incomplete evaluation of the partial decisions from left to right. Please determine the corresponding test data for each logical value combination that would lead to the appropriate logical values.

Complete Evaluation

	A	B	C	D	E	F	Total
	a<0	b>0	c==0	d!=0	A&&B	C&&D	E||F

Incomplete Evaluation from left to right

	A	B	C	D	E	F	Total
	a<0	b>0	c==0	d!=0	A&&B	C&&D	E||F

Definitions

simple condition coverage

test of all simple conditions concerning true and false

condition/decision coverage

test of all simple conditions + overall decision concerning true and false

Minimal Multiple Condition Coverage

all simple conditions + overall decision + composite conditions concerning true and false

Modified condition/decision coverage

requires test cases which demonstrate that every condition can influence the logical value of the overall decision independently of the other conditions

Multiple Condition Coverage

test of all value combinations of the conditions