Exam for ETS200 Software Testing
Lund University, Department of Computer Science
Time: 2013-03-14, 14:00-19:00
Place: Sparta: C–D
Assessment: total 60 points, at least 30 points is required in order to pass the exam.
Answers may be written in Swedish or English.
Start answering each new task on a new page.

---

1. Define the following terms (one sentence each):
   a) Testing b) Inspection c) Verification d) Validation e) Failure f) Oracle (6p)

2. a) Define the two main purposes of software testing, which sometimes may conflict. (1p)
   b) Give an example on how the two test purposes may conflict in practice. (1p)
   c) Give an example of a test metric that may be misleading due to the dual purpose of testing, and describe how this can be avoided. (2p)

3. Describe two different methods for test case design; one that uses a *black box* approach and one that uses *white box* approach. For each of the methods, present:
   a) a general description of the method, (2p)
   b) information needed to derive test cases using the method, (2p)
   c) which test levels the method is most feasible for, and why, (2p)
   d) main advantages of the method, and (2p)
   e) main drawbacks of the method.(2p)

4. For the procedure *SpeakingTimeToday* below,
   (a) draw the control flow graph and calculate the McCabe Cyclomatic Complexity, (3p)
   (b) define the test cases needed to achieve 100% decision coverage, (2p)
   (c) set up def-use tables for all three variables, and define minimum test cases needed to achieve 100% def-use coverage. (5p)

   Note that test cases should include both input values and expected output.

```
1  procedure SpeakingTimeToday (in listOfCalls; out speakingTime);
2  begin
3    callNum = 0
4    speakingTime = 0
5    while (callNum < listOfCalls.Length)
6       if listOfCalls[callNum].date = today
7            speakingTime = speakingTime + listOfCalls[CallNum].time
8       end
9       callNum = callNum  + 1
10   end
11 end
```

5. A medium-sized company wants to introduce a tool for automatic test execution.
   a) How much test code should they expect to write, compared to the production code? (1p)
   b) Which trade-offs should they do when deciding which test cases to automate? (1p)
   c) Define the three test automation approaches of *recorded scripts*, *engineered scripts*, and *model-based testing*. (3p)
   d) Discuss pro's and con's for the three approaches. You should at least cover:
      - Upfront investment costs
      - Test script maintenance costs
      - The *oracle* problem (3p)

(Cont'd on next page)

6. Derive test cases for the *NearestNeighbor* function, using *equivalence partitioning*.
`NearestNeighbor(in: listOfPos:matrixType, numNeighbors: int; out: pos:int);`
The *listOfPos* variable is a $3*(n+1)$ matrix of real numbers, representing 3D coordinates, as illustrated below. The input variable *numNeighbors*, represents the number of valid neighbors in the matrix, stored in positions 1 to *numNeighbors*. The reference coordinate is stored in position 0 of the matrix.

	0	1	2	...	NumNeighbors	...	n
x	0.4	0.8	-0.4	...	2.4	...	
y	0.5	0.8	0.9	...	0.6	...	
z	0	-0.8	14.1	...	-2.9	...	

The function calculates distances between the reference coordinate and coordinate m as $d_{0,m} = \sqrt{(x_0 - x_m)^2 + (y_0 - y_m)^2 + (z_0 - z_m)^2}$, and returns the index *pos* for the nearest neighbor. Define:

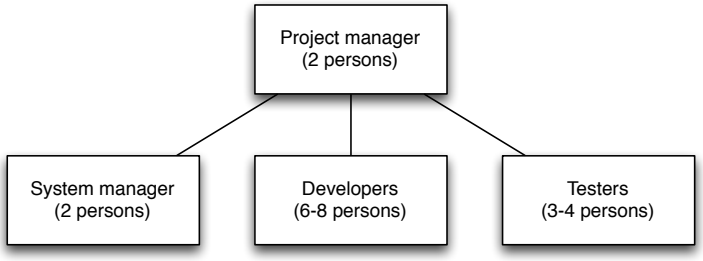
a) equivalence classes for input and output variables (both valid and invalid), including assumptions made regarding the specification of the program, (4p)
b) one test case per equivalence class (input data, procedures and expected output). (6p)

7. Two reviewers have inspected a document and found the defects listed in the table below, where 0 represents not found defect, and 1 represents found defect. The Lincoln-Peterson model estimates the number of defects as $\hat{N} = n_1 * n_2/n$, where
$\hat{N}$ = estimated total number of defects
n_1 = number of defects found by reviewer 1
n_2 = number of defects found by reviewer 2
n = number of defects found by both reviewers

Defect	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
Reviewer 1	1	1	0	1	1	1	0	1	1	1	1	0	1	1	1
Reviewer 2	1	0	1	0	1	0	1	0	0	0	0	1	1	0	0

a) Estimate how many undetected defects there are in the document. (1p)
b) Would you recommend release or re-review of the document, based on this estimate? Why? (3p)

8. The organization chart below comes from the PUSS course project.



a) Describe it in terms of the organizational models in Kit's book. (2p)
b) Select and describe an alternative organization based on another of Kit's models. (2p)
c) Discuss pro's and con's for the two alternatives. You should at least cover:
- competence provisioning,
- communication,
- management, and
- scale-up to large-size organizations.

(4p)