THE UNIVERSITY OF HULL

School of Engineering and Computer Science
Computer Science

Level 6 Examination

Semester 1

Academic Year: 2017/18

08335 – Advanced Software Engineering

2 hours

Answer ALL questions

(Each question is out of 20 marks)

You should answer all compulsory questions. If you do not attempt to answer a compulsory question you will receive a mark of 0 for that question.

If you have a choice of questions and you answer more than you are asked to, your answers will be marked in the order that the questions appear on the examination question paper. Any additional questions that you attempt will not be marked.

You should cross out any questions which you attempt but do not wish to be marked.

Do not open or turn over this exam paper, or start to write anything until told to by the Invigilator. Starting to write before permitted to do so may be seen as an attempt to use Unfair Means.

1 (i) With respect to structural (white box) testing, the branch coverage criterion is said to subsume the statement coverage criterion. Explain what this means and give a test set that illustrates how a branch coverage test set subsumes a statement coverage test set for the example program below.

```
if (x > 0) {
  if (y < 0) {
    return 1;
  }
}
return 0;
```

[2 marks]

(ii) For a given program and two coverage criteria C1 and C2, full coverage of the program under C1 requires twice as many test cases as does full coverage under C2. What can be said about the fault revealing effectiveness of the criteria C1 and C2?

[4 marks]

(iii) Consider the following program fragment where the input domain for x is {0, 2} and the input domain for y is {0, 1, 2}, i.e. six inputs in total.

```
n = x;
if (x > 1) {                          // if-0
  if (y == 1) {                   // if-1
    return n;
  }
}
if ((x == 0 && y == 0)
 || (x > 0 && y > 0)) {        // if-2
  return 3;
}
return 2;
```

(a) Complete the table below to indicate the branch executed at each if-statement in the program above when the test at the head of each column is executed.

	Tests			
	(x = 0, y = 0)	(2, 0)	(2, 1)	(2, 2)
if-0	F			
if-1				
if-2	T			
returns	3			

The bottom row of the table gives the value returned for each test.

[4 marks]

Question 1 continues…

(b) Give a minimal set of tests that achieves coverage of the feasible branches in the program.

[3 marks]

(c) By partitioning the input domain into subsets of inputs that produce the same output, give a minimal set of tests that achieve partition coverage for the program.

[3 marks]

(d) Consider a mutation of the program in which the expression y > 0 is replaced with n > 0. Give a test that will distinguish this mutant from the original program.

[4 marks]

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2 (i) Explain why a formal specification of a program is more useful if it is considerably shorter than the program that implements the specification.

[6 marks]

(ii) Given the following program

```
x = 0;
while (k != 8) {
   k = k - 2;
   x = x + 10;
}
```

where `k` and `x` are integer variables

(a) Identify the program input variable or variables. [2 marks]

(b) Identify the program output variable or variables. [2 marks]

(c) Give the pre-condition on the input that ensures that the program terminates.

[5 marks]

(d) Give the pre-condition on the input that ensures the program post-condition `x < 102`.

[5 marks]

End of Questions