**CS135 – Coursework 1**

**Note: wrong ticks lead to negative marks**

**Question 1:** Consider the following computation problem in one variable

**Sphinx:**

**Input** -25 <= x <= 20, x *∈* Z

**Output …**

Consider the following choices of values for x for Boundary Value Analysis (where the vector consists of (x\_min, x\_min+, x\_norm, x\_max-, x\_max)):

* C = (-25, -24, 0, 19, 20)
* D = (-16, -15, 3, 19, 20)
* E = (-25, -24, -24, 19, 20)
* F = (-25, -24, 5, 18, 19)

Say what holds for C, D, E, and F (several ticks per row are possible).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Vector is correct | x\_min wrong | x\_min+ wrong | x\_norm wrong | x\_max-  wrong | x\_max  wrong |
| C |  |  |  |  |  |  |
| D |  |  |  |  |  |  |
| E |  |  |  |  |  |  |
| F |  |  |  |  |  |  |

**[20 marks, 5 marks per correct row]**

**Question 2:** Consider the following computational problem

**AlteredPlus:**

**Input** -10 <= x <= 10, x Z; 20 <= y <= 40, y Z

**Output** the integer x+y+5

The following correct choices for x and y for Boundary Value Analysis

* C\_x =(-10, -9, 0, 9, 10)
* C\_y = (20, 21, 30, 39, 40)

and the test suites

S:

|  |  |  |  |
| --- | --- | --- | --- |
|  | x | y | Expected result |
| T1 | -10 | 20 | 15 |
| T2 | -9 | 21 | 16 |
| T3 | 0 | 30 | 35 |
| T4 | 9 | 39 | 53 |
| T5 | 10 | 40 | 55 |

T:

|  |  |  |  |
| --- | --- | --- | --- |
|  | x | y | Expected result |
| T1 | -10 | 20 | 15 |
| T2 | -9 | 21 | 17 |
| T3 | 0 | 30 | 35 |
| T4 | 9 | 39 | 53 |
| T5 | 10 | 40 | 55 |
| T6 | -10 | 30 | 25 |
| T7 | -9 | 30 | 26 |
| T8 | 0 | 30 | 35 |
| T9 | 10 | 30 | 45 |

U:

|  |  |  |  |
| --- | --- | --- | --- |
|  | x | y | Expected Result |
| T1 | -10 | 30 | 25 |
| T2 | -9 | 30 | 26 |
| T3 | 0 | 30 | 35 |
| T4 | 9 | 30 | 44 |
| T5 | 10 | 20 | 35 |
| T6 | 0 | 20 | 25 |
| T7 | 0 | 21 | 26 |
| T8 | 0 | 39 | 44 |
| T9 | 0 | 40 | 45 |

V:

|  |  |  |  |
| --- | --- | --- | --- |
|  | x | y | Expected Result |
| T1 | 0 | 21 | 26 |
| T2 | 0 | 20 | 25 |
| T3 | 0 | 30 | 35 |
| T4 | 0 | 39 | 44 |
| T5 | 0 | 30 | 35 |
| T6 | -10 | 30 | 25 |
| T7 | 10 | 30 | 45 |
| T8 | 9 | 30 | 44 |
| T9 | -9 | 30 | 26 |

Say what holds for S, T, U, and V (several ticks per row are possible):

|  |  |  |  |
| --- | --- | --- | --- |
|  | Is correct | Expected Result is wrong | Combination of the input values is wrong |
| S |  |  |  |
| T |  |  |  |
| U |  |  |  |
| V |  |  |  |

**[20 marks, 5 marks per correct row]**

**Question 3:** Consider the following computation problem in one variable

**Sphinx:**

**Input** -15 <= x <= 22, x Z

**Output** …

and the following decompositions of the input domain:

1. O = {[-15, 3), [2, 5], [6,22]}
2. P = {[-15, 3), [3, 5], [6,22]}
3. Q = {[-15, 3), (3, 6), (5,22]}
4. R = { {1,2,3,4,5,6,7,8,9,10}, {11,17,18,20}, {-1,12,14}, {5,15,19,21},

{-14,-15,-1}, {-13,-12,-11,-10,-9,-8} , {-7,-6,-5,-4,-3,-2,22 }}

Say what holds for O, P, Q, and R (several ticks per row are possible):

|  |  |  |  |
| --- | --- | --- | --- |
|  | Is a partition | does not cover | not all sets are pairwise disjoint |
| O |  |  |  |
| P |  |  |  |
| Q |  |  |  |
| R |  |  |  |

**[20 marks: 5 marks for each correct row]**

**Question 4:** Consider the following computation problem in two variables

**Mult:**

**Input** -17 <= x <= 20, x Z; 10 <= y <= 30, y Z

**Output** the integer x\*y

and the following partition of the input domains:

* Ax = {[-17,-1], [0,10], [11,20]} for the variable x
* Ay = {[10,12], [13, 30]} for the variable y

Consider the following test suites:

S:

|  |  |  |  |
| --- | --- | --- | --- |
| Name | x | y | Expected result |
| T1 | -2 | 10 | -20 |
| T2 | 0 | 10 | 0 |
| T3 | 11 | 13 | 143 |

T:

|  |  |  |  |
| --- | --- | --- | --- |
| Name | x | y | Expected result |
| T1 | -2 | 10 | -20 |
| T2 | -2 | 10 | -20 |
| T3 | 11 | 13 | 142 |

U:

|  |  |  |  |
| --- | --- | --- | --- |
| Name | x | y | Expected result |
| T1 | -5 | 12 | -60 |
| T2 | -5 | 20 | -100 |
| T3 | 15 | 11 | 165 |

V:

|  |  |  |  |
| --- | --- | --- | --- |
| Name | x | y | Expected result |
| T1 | -2 | 10 | -20 |
| T2 | 0 | 10 | 0 |

Say what holds for S, T, U, and V (several ticks per row are possible):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | is weak normal testsuite  for the given partitions of the input domains | there is a test case missing | there are several  test cases  representing  one class | there is an expected output  that has been wrongly computed |
| S |  |  |  |  |
| T |  |  |  |  |
| U |  |  |  |  |
| V |  |  |  |  |

**[20 marks: 5 marks for each correct row;]**

**Question 5:**

Consider the three sets

* R\_P = { (i,o) | on input i the program P) returns o}
* R\_T ={ (i,o) | for input i the test suite T says that the expected output is o}
* R\_S = { (i,o) | for input i the specification S prescribes output o}

Say what holds for R\_P, R\_T, and R\_S (several ticks per column are possible):

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Program P has same behavior as specified in S | Program P has less behavior than specified in S | Program P conforms to test suite T | Test suite T has outputs as prescribed as in the specification S | Test suite T has more behavior than specification S |
| R\_P = R\_S |  |  |  |  |  |
| R\_P ⊂ R\_S |  |  |  |  |  |
| R\_P ⊂ R\_T |  |  |  |  |  |
| R\_T ⊂ R\_P |  |  |  |  |  |
| R\_S ⊂ R\_T |  |  |  |  |  |
| R\_T ⊂ R\_S |  |  |  |  |  |

**[20 marks: 4 marks for each correct column]**