ECE 322
SOFTWARE TESTING AND MAINTENANCE
Fall 2019

Solutions

Assignment #2

Due date: Monday, October 7, 2019 by 3:00 PM
(return to the appropriate box- 2nd floor of DICE building)

Total: 40 points

Value 10 points

1. Develop software specifications for a simple e-shopping system using the formalism of finite state machines. Consider some selected functionality. Make appropriate assumptions.

Note: there could be a variety of possible solutions; there is nothing wrong about that. Your answer will be evaluated on a basis of its completeness and correctness (taking into consideration the assumptions you have made).

Solution
There could be very different solutions.

Value 10 points

2.Suggest a collection of test cases to test a procedure finding a maximum of three integer numbers

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maxofThreeNumbers(int n1, int n2, int n3)
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Consider (i) exhaustive testing and (ii) error guessing.

Solution
Consider that integers assume n bits, exhaustive testing requires $2^n * 2^n * 2^n = 2^{3n}$ test cases.
In error guessing, one can suggest a number of test cases:
positive and negative integer numbers,
all integer numbers are the same,
some of the integer numbers out of the range
symbols,
etc.

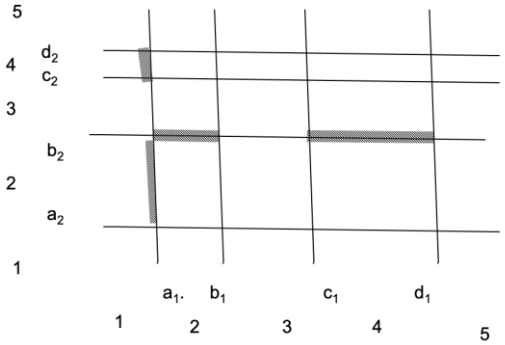
3.(i) Suppose that an application has n inputs (variables) and each variable partitions its input space in m equivalence classes. Determine the number of equivalence classes. How many tests do you require. Could be the number of tests made lower? Do detailed calculations for n =10 and m =10.
(ii) a system invokes function S if the reading of a given sensor is within the [a, b] or

[*c*, *d*], *b* <*c*. The entire range of possible values is [-50, 50]. Identify equivalence classes. List a collection of tests.
(iii) generalize the problem in (ii) by considering that there are two sensors where the function is invoked for the sensors' readings are in [a_i, b_i] or [c_i, d_i], $b_i < c_i$, i=1, 2. How many test cases do you require here.

Solution
(i)m^n The number of tests could be quite large, say for m =5 and n =50, one has 5^{50} Yes, if one consider the weak normal equivalence class testing, the number of test cases becomes reduced.
(ii) equivalence classes:
Valid equivalence classes: [*a, b*] and [*c, d*]
Invalid equivalence classes: [-50, *a*) (*b, c*) and (*d*, 50)
The number of test cases is equal to 5.
(iii)The equivalence classes for each variable (sensor) are

sensor 1
Valid equivalence classes: [a_1, b_1] and [c_1, d_1]
Invalid equivalence classes: [-50, a_1) (b_1, c_1) and (d_1, 50)
sensor 2
Valid equivalence classes: [a_2, b_2] and [c_2, d_2]
Invalid equivalence classes: [-50, a_2) (b_2, c_2) and (d_2, 50)

See the figure shown below



The number of test cases depends on the strategy being used
-for weak normal equivalence class testing
(2, 2) (2, 4) (4, 2) (4, 4) test cases include as many valid equivalence classes as possible each test case includes only one invalid equivalence class, say (1,2) (3, 2) …

-for strong normal equivalence class testing 5^2=25 test cases (1, 1), (1, 2)… (5, 5)

Value 10 points

4. Consider a 3-dimensional input domain described as

$$W = [0, 10] \quad [-5, 20] \quad [0, 7]$$

(viz. there are 3 input variables assuming values in the corresponding intervals). In this domain there are three equivalence classes

$W_1 = \{(x, y, z) \mid \max(|x-1|, |y-1|, |z-1|) \leq e\}$

$W_2 = \{(x, y, z) \mid \max(|x-5|, |y-10|, |z-4|) \leq e\}$

$W_3 = W - W_1 - W_2$

where e is a certain positive number. What should be possible values of e so that these equivalence classes form a partition?

Solution

Note that the expression $\max(|x-1|, |y-1|, |z-1|) \leq e$ describes a cube of a side $2e$ centered at (1 1 1). Likewise, the expression $\max(|x-5|, |y-10|, |z-4|) \leq e$ describes a cube of a side $2e$ centered at (5 10 4).

The distances between the centers along the x, y , and z coordinates are d_1, d_2, and d_3, respectively, Here $d_1=4$, $d_2=9$ and $d_3=3$

These cubes overlap (there is no partition) if $d_1<2e$ and $d_2<2e$ and $d_2<2e$. In other words, W_1 , W_2 and W_3 form a partition if $d_1=>2e$ or $d_2>=2e$ or $d_3=>2e$