ECE 322
SOFTWARE TESTING AND MAINTENANCE
Fall 2025

Assignment #2

SOLUTIONS

Due date: Monday, September 29, 2025 by 3:00 PM

Total: 40 points

Value 10 points

1.Pick up two e-shop apps; one coming from a big organization (e.g., Amazon, Temu) and another one coming from an on-line local shop. Propose a test suite, run the tests on these two apps and comment on the obtained results. Organize your results in a tabular format as shown below.

ID	Description	Expected results	Actual results

Solution
There could be different solutions depending on the details of the e-shops apps and tested functionalities.

Value 10 points

2.Suggest a collection of test cases to test a procedure finding an average of six integer numbers

```
Average_of_SixNumbers(int n1, int n2, int n3, int n4, int n5, int n6)
```

Integer numbers are represented using a 64-bit representation. Consider (i) exhaustive testing and (ii) error guessing.
If running a single test takes 10^{-6} sec, is the exhaustive testing feasible?

Solution
Consider that integers are represented using n bits. Then exhaustive testing requires
$2^n * 2^n * 2^n * 2^n * 2^n * 2^n = 2^{6n} = 2^{6*64} = 2^{384}$ test cases.
1 yr=$3.15*10^7$ seconds, $2^{23}=10^7$
$2^{384} = 2^{23} * 2^{361} \approx 10^7 * 2^{361}$
The time of running all the test cases: $10^7 * 2^{361} * 10^{-6}$ sec, which is not feasible.

In error guessing, one can suggest a number of test cases, for instance:
-positive and negative integer numbers,

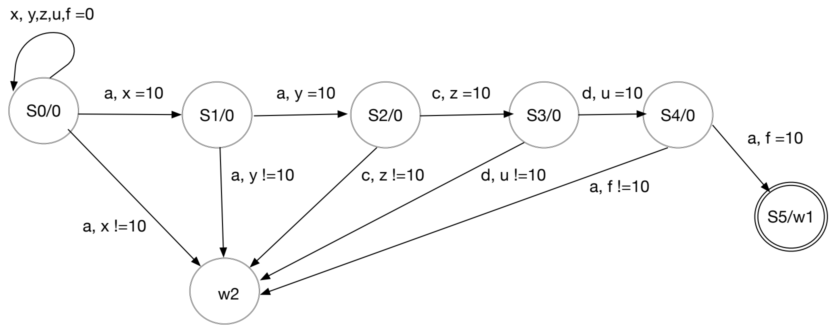
-all integer numbers are the same,
-all integer numbers are the same,
-some of the integer numbers out of the range
-the arguments are symbols,
etc.

Value 10 points

3.Consider the following three-class classification problem. If the sequence of symbols is *a b c d a a* and the occurrence between successive symbols is no longer than 20 msec then this sequence belongs to class ω_1. If the sequence of symbols is *a a c d a* and the occurrence between successive symbols is 10 msec, then this sequence belongs to class ω_2. If the time constraints are not satisfied, these two sequences are assigned to class ω_3. Propose some formal requirement for this classification problem.

Solution

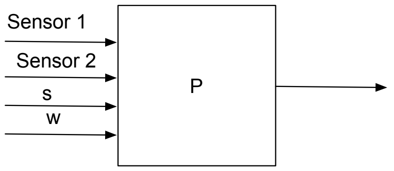
Below shown is a part of the solution (timed automaton) for the sequence *a a c d a*



Value 10 points

4.(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 you make the number of tests lower? Complete detailed calculations for *n* =20 and *m* =10.

(ii) Some procedure *P* has four inputs



There are the following valid ranges of input readings:

Sensor 1: (10, 25) or [29, 33] or (33, 35) [35, 36) or [37, 45]. The sensor generates positive readings with values in [0, range1], range1>50.

Sensor 2: [-1,1] or [4, 5]. The sensor generates both positive and negative readings from some range [-range2, range2], where range2 >5.

Control variable *s*: {1, 2, 3, 4, 5, 6, 7, 8}. The control variable assumes positive integer values {1, 2,... $s_{\max}$}, $s_{\max}$>8.

Control variable *w*: {-3, -2, -1}. The control variable assumes negative integer values

{-10, -9, …-4, -3, -2, -1}.

Identify equivalence classes in this problem.
Consider weak normal equivalence testing and strong normal equivalence testing.
(a)List the test cases for weak normal equivalence testing.
(b)Compute the number of the test cases required for strong normal equivalence testing.

Solution
(i)The number of equivalence classes is m^n. In particular, one has 10^{20}. The number of test cases could be reduced by considering a certain testing strategy, for instance each choice coverage criterion.

(ii) Equivalency classes are listed below (invalid classes are shown in red)

Sensor 1:
$[0,10]_{\mathbf{1}}$ $(10, 25)_{\mathbf{2}}$ $[25, 29)_{\mathbf{3}}$ $[29, 33]_{\mathbf{4}}$ $(33,35)_{\mathbf{5}}$ $[35, 36)_{6}$ $[37, 45]_{\mathbf{7}}$, $(45, \text{range1}]_{\mathbf{8}}$

Sensor 2: $[-\text{range2},-1)_{\mathbf{9}}$ $[-1,1]_{\mathbf{10}}$ $(1,4)_{\mathbf{11}}$ $[4, 5]_{\mathbf{12}}$ $(5, \text{range2}]_{\mathbf{13}}$

Control variable s: $\{1,2, 3, 4, 5, 5,7, 8\}_{\mathbf{14}}$ $\{5, 6,\ldots,s_{max}\}_{\mathbf{15}}$

Control variable w: $\{-3, -2, -1\}_{\mathbf{16}}$ $\{-10, -9,\ldots-4\}_{\mathbf{17}}$

Using the weak normal equivalence class strategy, the tests are:

(1, 10, 14, 16), (3, 10, 14, 16), (5, 12, 14, 16), (8, 12, 14, 16),
(4, 9, 14, 16), (5, 11, 14, 16), (7, 13, 14, 16),
(6, 12, 15, 16),
(6, 12, 14, 17).

There could be some other options depending which combinations of valid and invalid equivalence classes have been selected.

Using the strong normal equivalence class strategy, we end up with 8*5*2*2 = 160 tests.