CS 5/7314: Software Testing & Quality Assurance

Exam #2

April 3, 2024

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Exam grade: 43.5/50

General Instructions

- *This is a closed-book exam*, but one summary sheet (8x11, letter sized, single or double sided) is allowed.
- *Read exam questions carefully* before answering them.
- *There are three questions*, totaling 50 points. The point distribution is shown by each question.
- *Exam duration for on-campus students* (& distance students taking the exam on campus): 75 minutes.
- Distance students:
  1. Exam start time: You may start anytime after 2pm, 4/3/2024.
  2. Exam duration: 90 minutes total, including 75 minutes for taking the exam and an extra 15 minutes to handle the scanning/uploading/submission/etc.
  3. Deadline for exam submission: 90 minutes after you start your exam & before 3:30pm, 4/5/2024.
  4. You need around 3 sheets of blank paper to write your answers (no pencils, please, to ensure readability of the scanned exam).
  5. Be sure to clearly identify question numbers.
  6. When you finish answering the questions, you need to scan your answers and upload it to Canvas for submission.
  7. When upload your completed exam for submission, please try to use a single file, if possible.
- **Good luck!**

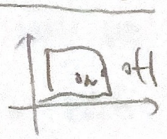
I. Choose *one* best answer for each question ..... 11.5/15 ..... *(3 points each, 15 points total.)*

1. Classify the following testing techniques to their model types:

i. PT	a. ad-hoc/informal
ii. BT	
iii. Markov OP	b. partitions
iv. CFT	
v. DFT	
vi. Musa OP	c. FSM

3/3

2. For a 2-d closed domain, where should the OFF point be for Weak 1x1 BT testing?
   a. inside the domain.
   b. on the boundary.
   c. outside the domain.
   d. at a vertex point.
   e. (x_0, y_0), where x_0 and y_0 are the minimal values for x and y respectively.
   f. (x_1, y_1), where x_1 and y_1 are the maximal values for x and y respectively.
   g. (x_0, y_1).
   h. (x_1, y_0).

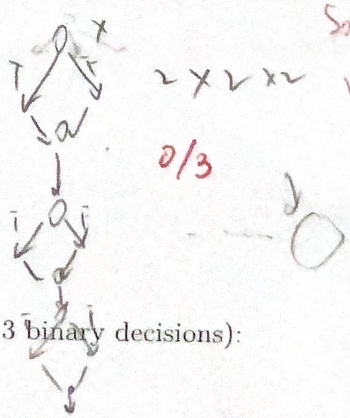


3/3

3. Mark true or false (T/F) for each of the following statements regarding Markov OP:
   a. The link probabilities are history dependent.
   b. The link probabilities are history independent.
   c. The sum of link probabilities for all outgoing links from a state is 1.
   d. The sum of link probabilities for all incoming links to a state is 1.
   e. The sum of link probabilities for all outgoing links from a state is 0.5.
   f. The sum of link probabilities for all incoming links to a state is 0.5.
   g. Path probability = product of link probabilities for all links in the path.
   h. Path probability = sum of link probabilities for all links in the path.

2.5/3

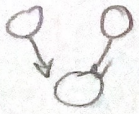
4. The number of realizable paths s for the sequential concatenation of 3 binary decisions is:
   a. $s = 1$, because it is sequential.
   b. $s = 2$, because of the binary (2) decisions.
   c. $s = 3$, because there are 3 decisions
   d. $s = 6$: 3 decisions times 2 possibilities for each binary decision.
   e. $s = 8$: 2x2x2 or 2^3 for the decision combinations.
   f. $s \leq 8$, because some paths may not be realizable.
   g. All of the above.
   h. None of the above.



0/3

5. Consider the DDG for the above program (sequential concatenation of 3 binary decisions):
   a. The DDG will contain three independent data selector nodes.
   b. The DDG will contain three nested data selector nodes.
   c. The DDG will contain three data selector nodes, possibly linked by the data items defined or used.
   d. The DDG will be uniquely determined by the CFG.
   e. DDG = CFG for this program.
   f. All of the above.
   g. None of the above.

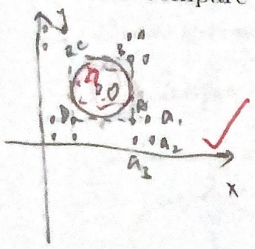
3/3

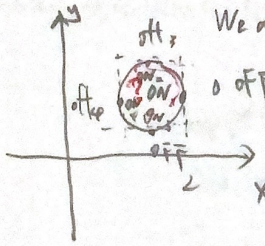


II. Testing Techniques: Comparison ..... 13/16 ..... *(8 points each. 16 points total)*

1. During the total solar eclipse of 4/8/2024 observable from Dallas, the corona can be represented by the bright ring visible while direct-sunlight is blocked by the moon. Model the corona observation as a BT problem, and compare the effectiveness and cost of EPC and Weak 1x1 BT strategies.

Sol:





Weak 1x1

- OFF_1

- W1x1 points are incorrect.
- Missing inner ring boundary.
- W1x1 missing inner ring boundary points.

5/8

EPC:

During the domain.

We can have 4 Extreme points

A, B, C, D

For every EP_i we can have

A: a_1, a_2, a_3

B: b_1, b_2, b_3

C: c_1, c_2, c_3

D: d_1, d_2, d_3

We also can have one pointer inter O

Therefore, we have Test point: $4^n + 1 = 4^2 + 1 = 17$ ✗ 16

Suppose we can have 4 boundries now.

For each boundary, we can one ON point on the circle and one OFF points.

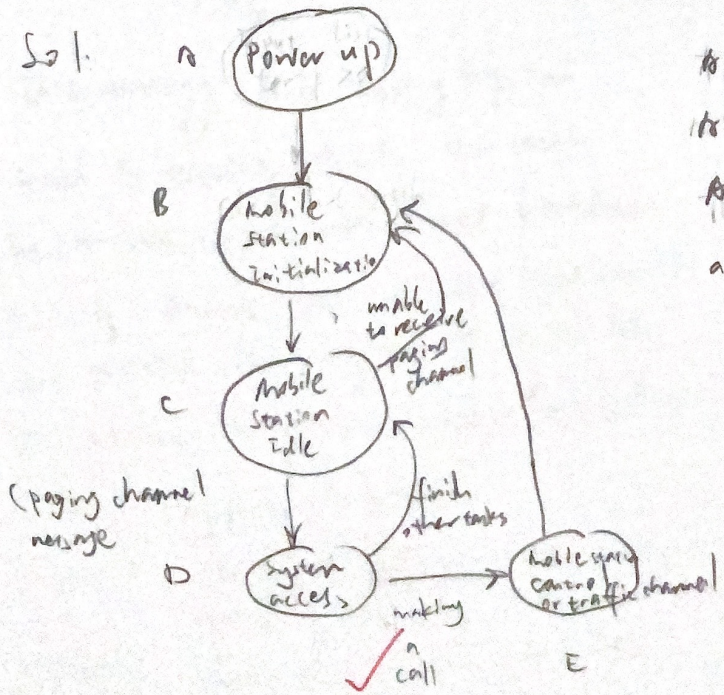
Therefore we can (ON_1, OFF_1), (ON_2, OFF_2), (ON_3, OFF_3) (ON_4, OFF_4) and inter points O

∴ We $2b+1 = 2\times 4 + 1 = 9$ ✗ 4 test points

For the effectiveness with them, Weak 1x1 more effective than EPC. And to the cost, Weak 1x1 has less test points than EPC ✓

2. Starting with a simple FSM of your choice, construct your test cases.

Sol:



AB, ABC, ABCB, ABCD, ABCDC, ABCDCB, ABCDE, ABCDEB,

Above are the paths, therefore I can cover all the Nodes and the path to generate test cases ✓

T_1: AB

T_2: ABC

T_3: ABCB

T_4: ABCD

T_5: ABCDC

T_6: ABCDCB

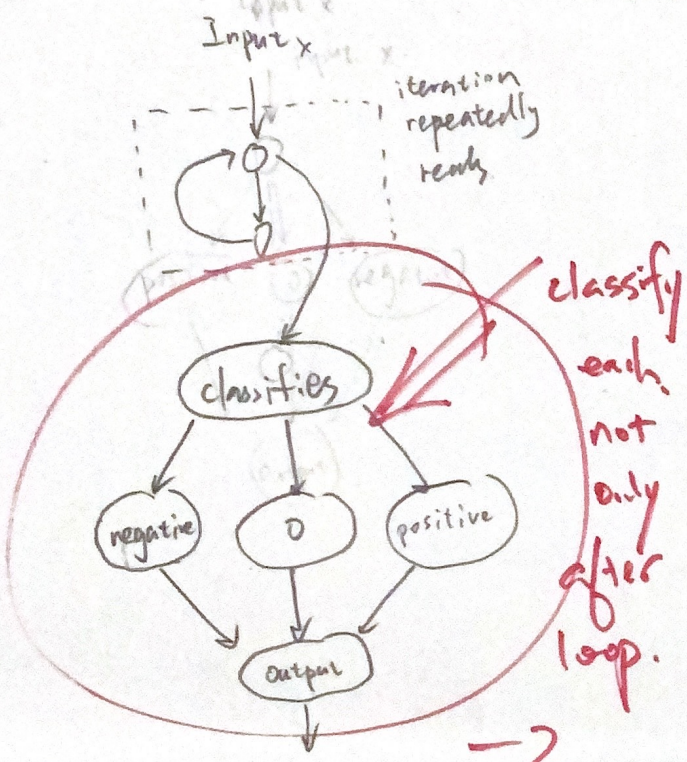
T_7: ABCDE

T_8: ABCDEB ✓

8/8

III. Testing ..... *(19 points total)*

1. A software repeatedly reads numerical input and classifies each into one of three categories: positive, 0, and negative. Outline your testing strategies for CFT and DFT, then construct your CFG and DDG, determine the number of test cases and sensitize at least one of them for each testing technique. (Make necessary assumptions as needed, especially for DDG construction.)



CFG

test strategy: Since testing loops can lead to testing infinite test cases, we can use upper and lower bandaries to help ensure that all the test cases are covered. The way to do so will be to create three test cases as follows.

Case 1: By pass the loop

Case 2: check if program can enter the loop for one iteration

Case 3: Check if program can enter the loop for 2 iterations

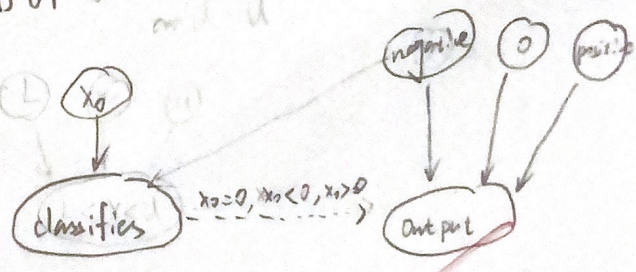
Case 4: Check if program for k iterations.

Therefore the test cases loop (by pass, once, twice, k) 4 time

$4 \times 3 = 12$ test cases.

DDG

Suppose the computer in the loop can make sure x_0 will not out of boundary, for the DDG, I clapse loop in to the one node (x_0). And Then the DDG is in the following.



Strategy: I clapse loop into one node

Therefore, there are 3 slices of the graph

Test 1: $x_0 = 0 \Rightarrow$ output $\Rightarrow$ 0

Test 2: $x_0 = -1 \Rightarrow$ output $\Rightarrow$ negative

Test 3: $x_0 = 1 \Rightarrow$ output $\Rightarrow$ positive

Show slice.

-1