CSE 4321/5321 Homework 2

Spring 2017

**Question 1-3 worth 10 percent each. Question 4 is worth 30 percent. Question 5 is worth 40 points. 100 points total**

The following are customer descriptions of software scenarios. For each problem state any assumptions made - but **do** **not** **change** the function being described.

For problems 1-5

1. develop the minimum set of test cases needed to adequately test all actions and boundary values.
2. List all inputs and expected outputs.
3. Develop the test needed for the valid partitions only. Develop 2 test cases per ECPs (if it is possible to have two input values for a ECP).
4. Calculations. Assume that currency is truncated to the cent. Other truncation as indicated.

1) Fuel level is calculated as follows: if the tank has 100 gallons it is "full", if not full but greater than 75 gallons it is "3/4 full", if less than or equal to 75 gallons and greater than or equal to 50 gallons "1/2 full", if less than 50 gallons and greater than 25 gallons "1/4 full", otherwise "empty". Fuel level ranges from 0 to 100 gallons inclusive and is a double with 0.01 gallons significance.

SOLUTION

The ECP/BVA for fuel looks like the following (all values represent gallons - in some cases trailing zeroes are omitted to reduce space): **THIS IS NOT GRADED**



We see that because of the range of fuel level the last ECP is one-sided and will give us a total of 9 test cases. The test cases are as follows: **THIS IS GRADED**



2) A 4-engine drone uses the following forward velocity rates: when the drone is over 100 feet above the ground, 25 fps, otherwise when at 75 feet and over, 15 fps, otherwise when over 50 feet above the ground, 10 fps, otherwise when at 25 feet and over, 5 fps, otherwise when at 0.5 feet and above, 2.5 fps, and otherwise the forward velocity is 0 fps and the motor is turned to "off". Drone altitude and forward velocity are both doubles with 0.1 significance. Altitude is 0 to 200 feet inclusive. Each motor is capable of 1/4 the total output of the drone - drone forward velocity is a single double set by the software.

SOLUTION

The ECP/BVA for altitude above ground looks like the following (all values represent feet - in some cases trailing zeroes are omitted to reduce space): **THIS IS NOT GRADED**



The test cases are as follows: **THIS IS GRADED - Units must be shown and both altitude above ground and forward velocity must be shown to the 0.1 significance (trailing zeroes may be omitted).**



3) The interest rate paid is 2.255% if the account balance is between $800 and $3,500, 1.55% if less than $800, and 3.155% if greater than or equal to $3,500. A fee of $500 is charged for an overdraft account and a credit of $100 is provided for a computed balance (balance with interest) if the computed balance (excluding credit) exceeds $250,000. A inactive account fee of $150 is charged for balances of $0.

SOLUTION

The ECP/BVA for balance looks like the following (all values represent $balance - in some cases trailing zeroes are omitted to reduce space): **THIS IS NOT GRADED**



The test cases are as follows: **THIS IS GRADED -**

1. **Currency and thousands separators must be shown**
2. **For test cases 10 and 11 the credit is reflected in the expected output (as indicated in bold).**
3. **Note truncation on expected output of balance.**



4) Convert the first three problems above into decision tables. Divide this problem into parts a) b) and c) for problem 1, 2 and 3 respectively. For each, provide

1. the decision table
2. the number of test cases required (do not supply the specific test cases)
3. does this number agree with the number of tests developed above? Yes or No. If no, why not?

SOLUTION

a1) the decision table is as follows:



Grading notes:

1. The table must be an unbalanced table as shown above.
2. The table must say "table implements first of rule".
3. The table must show units on the input variable fuel.
4. The table must show the significance of x.xx gallons (trailing zeroes are not required).
5. For each condition, the upper and lower BVs must be inclusive (as shown above). In other words "0.00 <= fuel (gallons) <= 25.00" - logical comparators must be used and must be "<=".
6. The table must show the fuel level labels as indicated above.
7. The answer must indicate the number of test cases and whether it agrees with above.

a2) the number of test cases are 2\*4 + 1 = 9 tests.

a3) This is the same as above.

b1) the decision table is as follows:



Grading notes:

1. The table must be an unbalanced table as shown above.
2. The table must say "table implements first of rule".
3. The table must show units on the input variable aag (altitude above ground).
4. The table must show the significance of x.x feet (trailing zeroes are not required).
5. For each condition, the upper and lower BVs must be inclusive (as shown above).
6. The table must show both forward velocity and motor status. Forward velocity must have units.
7. The answer must indicate the number of test cases and whether it agrees with above.

b2) the number of test cases are 6\*2 = 12 test cases.

b3) this agrees with above.

c1) the decision table is as follows:



Grading notes:

1. The table must be an unbalanced table as shown above.
2. The table must say "table implements first of rule".
3. The table must show currency on the inputs and outputs. For rate the table must show either percentage or representation of one (e.g., 1.0 = 100%).
4. The table must show the significance in cents (trailing zeroes are not required). For interest, as above.
5. For each condition, the upper and lower BVs must be inclusive (as shown above).
6. The table must show rate, fee, and credit.
7. The answer must indicate the number of test cases and whether it agrees with above.

c2) The number of test are 5\*2 + 1 = 11 test cases.

c3) This agrees with above.

5) Arlington Enterprises is developing a fuel pump - it doesn't have all of the full features of some fuel pumps, but we are hoping that the basic features will ensure high volume and keep our cost competitive.



The fuel pump system consists of a Gas Pump System, Gas Pump Panel, and two sensors: Gas Pump Nozzle Head (in holder), and Gas Pump Nozzle Flow (squeezable handle). The Gas Pump Panel has a Display (text message) and two buttons Start and Stop. Inside the station the cashier presses a Paid button indicating the fuel has been paid for.

Gas Pump Buttons

**Nozzle Sensors (2)**



The customer purchases gas as follows (must follow this sequence)

1. "Welcome"
   1. When the display (O) shows the "Welcome" message, the customer presses the Start button (S=true) and the software displays a "Ready" message.
   2. All other inputs but S are ignored.
2. Once "Ready"
   1. the customer removes the Gas Pump Nozzle Head from its holster (this causes the Gas Pump Nozzle Head sensor to give a H=true input). The software displays the message "Dispensing".
   2. All other inputs but H are ignored.
3. Once "Dispensing"
   1. The customer squeezes the Gas Pump Nozzle Flow handle (F=true). When F=true the software sets R=true.
   2. If H==false then the software returns to "Ready"
   3. The inputs S and C are ignored
   4. When the customer presses the Stop button (T=true) the software stops the fuel flow and displays O="Please pay cashier $"+D\*2.09 (truncated and significant to the cent). Otherwise, the fuel continues to be dispensed when the customer squeezes the handle.
4. Once "Please pay cashier $"+D\*2.09
   1. When the customer has paid the cashier, the cashier presses the Paid button which provides a C=true input to the software. This causes the display to show the "Welcome" message and the software awaits the next customer.
   2. At this point the inputs S, T, H, and F are ignored before the C input is received.

The software MUST not allow fuel to flow except when "Dispensing" is displayed and when the handle is squeezed. This is a safety feature.

The value of D is set to 0.0 by the software when either the system starts-up or when the cashier presses the Paid button. D is both an input and an output. When dispensing gas, the hardware sets the D value to the amount dispensed.

C is ignored except after the Stop button is pressed.

O (the value for the Gas Pump Display message) is an output of the software. It is a String in Java. When the system powers-up it displays the "Welcome" message and awaits further inputs.

During pumping, R is an output of the software used to turn on the pump motor which dispenses gas. Internally to the hardware, the system measures D when R=true. R is set to false at start-up by the hardware, but is set to false by the software when C=true.

All inputs are set to false at start up and when the cashier presses the Paid button by the hardware - the software does NOT do this.

Develop

1. Two tables - inputs and outputs of the software.
2. Test case table.
3. State diagram.

Draw the simplest state diagram (Mealy)

1. make sure all inputs and outputs are depicted where required.
2. For the state diagram label each input and output using the single letter indicated above (text should use the string e.g. O="Welcome"). If B=true then show this as B and if B=false as !B.
3. Each state is labeled S0, S1, ... SN

Label the inputs and outputs of the software as two tables (one each). List the label name (e.g., D), what it means, its type and its significance (if numeric).

Develop the test case table

1. with all inputs and expected outputs depicted
2. test all transitions and all states (not just unique transitions).
   1. The test case table should examine each transition from each state on the diagram - you are NOT required to examine all possible combinations of inputs.
   2. For states with transitions that have the same response (S, F, or T) develop a separate test case for each transition for that state.
3. Use the abbreviated inputs and outputs described above in your test case table
4. When the logic on a transition has two or more conditions (represented by an And or an Or), you need to capture all possible combinations in your test case table.

The state diagram may be hand drawn and a picture submitted, BUT the submitted picture must be gradable.

SOLUTION

1. Input and Output tables. These follow. GRADING NOTES - I am just looking for a listing and description of all inputs and in the second table all outputs, nothing else is required. No specific fields are required - we're simply listing the inputs to and the outputs of the software.





2. The state diagram follows.



In the diagram above, the input and output D is in gallons.

S0 is the "Welcome" state. S1 is the "Ready" state - when the start button has been pressed. S2 is the "Dispensing" state when the Fuel nozzle has been removed from the holder (holster). When dispensing

1. if the Nozzle is out of the holder and the fuel handle is squeezed (F=true) we turn on the pump
2. if the fuel handle is not squeezed we turn off the pump.
3. If the nozzle is placed back in the holder (holster) we go back to the "Ready" state.
4. If the Stop button is pressed we stop the pump, display the total price and go to the "Waiting for payment" state (S3).
5. If S or C are pressed while pumping this is also okay - it won't cause a safety problem so we don't need to shut off the pump.

When waiting for payment - we wait for the cashier to press the C button - when this happens we set D=0.0 gallons, set the display to "Welcome" and go to the "Welcome" state.

3. The test case specification is as follows: THIS IS NOT GRADED



The test case specification table shows us the requirements for test - we see what values are significant and those that are not.

The test case table follows - each input and output must have a specific value. THIS IS GRADED.



Values in the yellow cells indicate that they have some considerations:

1. D as an input can be any value. D as an output - the value must be correct given the input.
2. R - even thought this is shown as a don't care it would be erroneous to set R=true as one of the don't care values above.
3. For test case 13 above D may be any value other than 0.0. The test case needs to show correct calculation of the amount of fuel dispensed truncating to the cent.