UNITED INTERNATIONAL UNIVERSITY (UIU)
Dept. of Computer Science & Engineering
Trimester: Fall 2022
Course No: CSE 4495   Title: Software Quality Assurance and Testing
Section: A and B
Assignment - 2

There is a single problem in this assignment. Discuss with your teammates and submit one file (per group) in eLMS containing the solution. No more than 5 students per group is allowed.

Cover Page: On the cover page of your assignment, include the name of the course, the date, your group name, and a list of your group members.

Problem Description:

: Suppose you are designing an AI that patrols an area to find enemies and shoot at sight. But you want your AI to be interesting so you try to make it behave somewhat like a human.

If it patrols for more than 30 minutes it gets hungry and looks for food. If it finds an enemy while eating it will drop the snack and immediately start shooting the enemy. Otherwise it will go back to patrolling after its break is finished.

The enemies are also armed sometimes. If your AI sees the enemies have grenades with them the AI will dive for cover. Once it dives for cover it will either shoot or start patrolling again based on enemy visibility.

If your AI kills 20 enemies it will go home for the day (we can consider shooting once kills the enemy). Now take a look at the variables and their possible values –

State: patrol, takeABreak, eatFood, dropSnack, shoot, dive, home
Action: getFood, finishBreak, enemySightedInBreak, enemySighted, noEnemySighted, grenadeSighted
Timer: 0..30
Killed: 0..20

Now in this assignment your job is threefold-

1. Designing the finite state model and implementing it in **NuSMV.**
2. Expressing the following informal requirements for this AI in temporal logic (CTL or LTL).
3. Actually checking these if these requirements hold against your implemented **NuSMV** model.

So your report will have three sections –

Section 1 : NuSMV implementation (8 points):

In this section first design the finite state model (FSM). Next code up the model in NuSMV notation. Your code will look something like this –

```
MODULE
      ai
VAR

      State: {patrol, takeABreak, eatFood, dropSnack, shoot, dive, home;
```

```
      Action: {getFood, finishBreak, enemySightedInBreak, enemySighted,
noEnemySighted, grenadeSighted};
      Timer: 0..30;
      Killed: 0..20;

ASSIGN
      init(State) := patrol;
      init(Timer) := 0;
      init(Killed) := 0;

      next(Timer) := case
            Timer >= 0 & Timer <= 30 & State= patrol: Timer + 1;
            Timer > 0 & Timer <= 30 & Action = finishBreak: 0;
              --Write your code here to complete
              -- Suggestion: Start by defining the conditions that would cause
              -- the variables to change. Do this for each variable
              --and write the next step with a switch case for each variable.
              -- Finally, ensure it will continue running if it is supposed to. (FILL THIS IN);
```

As you can see some of the code (some changes of Timer variable) is already done for you. Finish the rest of it with the change in all other variables and include the complete code in your report. You should create a **.smv** file with this code.

Section 2 : Requirement Generation (5 points):

- A list of informal requirements is given below –
  - If the AI is eating and it finds an enemy it will drop the snack.
  - If the AI starts shooting it will eventually go home.
  - If the AI isn't patrolling it will not get hungry.
  - The AI might not always dive
  - The AI will always go back to patrolling once its break is finished.
- Write down at least 5(five) informal requirements yourself for the model.
- Translate all the requirements (including the five stated above) into temporal logic expression (minimum 5 CTL and 5 LTL expressions).
- Include these requirements in your .smv file created in section-1

Section 3 : Finite State Verification (7 points):

Now verify your model against these requirements. To complete this section visit the NuSMV website: https://nusmv.fbk.eu/. Download and run NuSMV 2.6.

Execute your .smv file with NuSMV and add the consequent screenshot of the NuSMV Console to your report. After you finish this section you have completed your assignment. Congratulations!

Submission Instructions & Deadline:

Now put your .pdf report and .smv source code file inside a folder and zip the folder. **Submit the zipped folder in eLMS window. Only the team leader's submission is sufficient.** Remember to mention all teammates' name and IDs' on the report cover page.

Deadline : 12-01-2022 (Thursday) 11:59pm. This deadline is non-negotiable and no submissions will be accepted post deadline, regardless of any unfortunate circumstances.