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Term Milestone Part 1

Project 5: Happy Heart Program

Agile: Planning the Project:

This is a heart function monitoring system that will raise an alarm if there is something wrong. It will be monitoring Pulse Rate, Blood pressure, and Blood oxygen level. This is a simulation so the data will be imported or typed in.

Requirements:

Inputs - There will need to be a way to read in the data from a file or be typed in manually

- Filename can be given on command line and there isn't one then assume the input will be manually entered with the keyboard.
- The file input will need to simulate collecting data every 10 seconds or the user will need to enter every 10 seconds.
    - Each line input will need a pulse reading, an oxygen level (which might not be there), and a blood pressure (which is often not there.)
- Pulse and oxygen level will be read every time and get a blood pressure reading at irregular intervals (somewhere around every few minutes(not specified))

Outputs – Every time data is read it needs to be printed out with a time stamp, alert level, then a description of the problem causing the alert.

- Start time at 0 and do it in 10 second intervals.
- Alert levels are as followed: None, Low, Medium, Highest
- Description are as followed:
    - None: "Everything Normal"
    - Low: either "Blood Pressure Above Normal" or "Blood Pressure Below Normal"
    - Medium: "Blood Pressure is too High" or "Blood Pressure is too Low"
    - Highest: "Blood Pressure is Dangerously High" or "Blood Pressure is Dangerously Low"
- Times are mm:ss, and wrap around every hour.

Incorrect Data – Bad data or impossible values are considered equipment malfunction and should be a minor alarm.

- Wrong inputs should tell user and mark it as invalid and keep program running.

Monitoring Alert Levels:

Alarm Levels:

Pulse:

1. Under 20 – highest
2. Under 40 – medium
3. Above 110 – low
4. Above 130 – medium
5. Above 170 – highest
6. Above 210 is impossible

Oxygen:

The oxygen level is based on a one minute moving average of the oxygen level.

1. Average below 50% -- highest
2. Average below 80% -- medium
3. Average below 85% -- low
4. If the reading is missing for 30 seconds (3 consecutive readings), this is a low alarm. It usually indicates that the reading device fell off the patient's finger. (This invalidates the moving average.) (If the data is missing for one or two readings, assume that the value is the same as the last reading.)
5. If the oxygen level average is displayed, display it with one digit to the right of the decimal point ($1/10^{th}$ accuracy)
6. Levels of 0% or less, and 100% or higher, are of course impossible.

Blood Pressure:

In the blood pressure, raise an alarm if either of the numbers exceeds the threshold.

1. Above 200/120 – medium
2. Above 150/90 – low
3. Below 70/40 – medium
4. Below 50/33 – highest
5. Levels above 230/150 are impossible.
6. Since blood pressure is taken at irregular intervals, if it doesn't appear, that isn't a problem. If there is an alarm active for blood pressure, keep it until you get another reading.

Project Pulse levels:

- 0 – 19 = "Pulse Extremely Low:" Alert Level = Highest
- 20 – 39 = "Pulse Below Normal:" Alert Level = Medium
- 40 – 110 = "None" Alert Level = None
- 111 – 130 = "Pulse Slightly Above Normal:" Alert Level = Low
- 131 – 170 = "Pulse Above Normal:" Alert Level = Medium
- 171 – 210 = "Pulse Extremely High:" Alert Level = Highest

Project Blood Oxygen levels:

- 0 – 49 = "Oxygen Extremely Low:" Alert Level = Highest
- 50 – 79 = "Oxygen Really Low:" Alert Level = Medium
- 80 – 84 = "Oxygen Low:" Alert Level = Low

- 85 – 99.9 = “None” Alert Level = None

Project Blood Pressure Levels (systolic(top) and diastolic(bottom)):

- Systolic > 200 = "Pressure Dangerously High:" Alert Level = Medium
- Systolic 151 – 199 = "Pressure Somewhat High:" Alert Level = Low
- Systolic 70 – 150 = "None" Alert Level = None
- Systolic 69 – 50 = "Pressure Somewhat Low:" Alert Level = Medium
- Systolic < 50 = "Pressure Dangerously Low:" Alert Level = Highest
- diastolic > 200 = "Pressure Dangerously High:" Alert Level = Medium
- diastolic 151 – 199 = "Pressure Somewhat High:" Alert Level = Low
- diastolic 70 – 150 = "None" Alert Level = None
- diastolic 69 – 50 = "Pressure Somewhat Low:" Alert Level = Medium
- diastolic < 50 = "Pressure Dangerously Low:" Alert Level = Highest

Ranges for Each category:

- Pulse Rate- Range: 0 – 260
- Blood Pressure- systolic/diastolic range: systolic – 0-260, diastolic- 0-150.
- Blood oxygen level- Range: 0 – 99.9

Agile: Creating the Product Roadmap

- 09/24 – 10/09 coding

- 10/10 – 10/16 Test plan

- 10/16 – 10/23 Test: Inputs, Frequency, Alerts, Time

- 10/23 – 10/30 Test: Data, Bad Data, Monitoring, Oxygen

Agile: Planning the Release

The project is due October 30th so this is the release date.

Agile: Planning the Sprint(s)

Sprint 1: 09/24 – 10/09, Develop code to the requirement specifications.

Sprint 2: 10/10 – 10/16, Code, Create test plan to the requirement specifications.

Sprint 3: 10/16 – 10/23, Code, Test: Inputs, Frequency, Alerts, Time

Sprint 4: 10/23 – 10/30, Code, Test: Data, Bad Data, Monitoring, Oxygen

Agile: 2week Stand-up Meetings

09/25: Sprint 1- Start coding

10/09: Starting coding/sprint 1 start sprint2 and when done do sprint3. Missing requirements to work on. Start creating test plan. Run sprint 3 tests after test plan created.

10/23: Work on sprint 4.

Agile: Sprint review and retrospective meetings

09/25: Sprint1 - Coding.

10/09: Some unfinished requirements: Randomly getting pressure inputs, always getting oxygen level. Start test plan and while testing address missing requirements if possible. Do sprint 2 and then 3.

10/23: Sprint 4.

Testing Plan:

Scope:

Inputs: Test if it allows the data to be read in from a input file or data to be entered in manually through the keyboard.

Frequency: Test to see if it is getting a pulse and oxygen level every 10 seconds and pressure at random.

Alerts: Test alerts to see if the proper alert is showing depending on the level and the test that's being run.

Time: Test to see if time wraps around every hour.

Data: Test to see if the program displays correctly when oxygen and/or pressure is not entered/given.

Bad Data: Test to see if program recognizes bad data and reports it as invalid.

Monitoring: Test that it is showing the highest alarm level when there are multiple alarms in the order of precedence.

Oxygen: Test if displays previous level if no input is given or alert if 3 consecutive no inputs.

Strategy:

Inputs: Decision Coverage Testing

Testing: readInData() and manualInput() functions

- Input: yes, Output: file input.
- Input: no, Output: manually input.
- Input: Anything else, Output: re-enter option.

Frequency: Equivalence Testing

Testing: manualInput() funtion

- Input: 2 lines of data, Output: 10 seconds.

Alerts: Boundary Testing

Testing: alertLevel() function

- Pulse:
  Testing: pulseRate() function
  - Testing all level boundaries (Boundary testing, tests are at the end)
- Oxygen:
  Testing: bloodOxygenLevel() function
  - Testing all level boundaries Testing all level boundaries (Boundary testing, tests are at the end)
- Pressure:
  Testing: bloodPressure() function
  - Testing all Systolic level boundaries Testing all level boundaries (Boundary testing, tests are at the end)
  - Testing all Diastolic level boundaries Testing all level boundaries (Boundary testing, tests are at the end)

Time: Equivalence Testing

Testing: readInData() function

- Input: 8 lines of data, Output: 1 min 10 sec.

Data: Decision Coverage Testing

Testing: I was unable to implement a way to not have all 3 inputs entered. Therefor I am unable to test these.

- Input: Pulse, Output: Check alert for pulse and oxygen (based on previous oxygen reading).
- Input: Pulse and Oxygen, Output: Check alert for pulse and oxygen (based on previous oxygen reading).
- Input: Pulse Oxygen Pressure, Output: Check alert for pulse, oxygen (based on previous oxygen reading) and pressure.
- Input: No inputs, Output: Display: invalid

Bad Data: Equivalence Testing

- Pulse:
  Testing: pulseRate() function
  - Input: 211 =Output: Invalid Input
  - Input:-1 =Output: Invalid Input
- Oxygen:
  Testing: bloodOxygenLevel() function
  - Input : 101 =Output: Invalid Input
  - Input: -1 =Output: Invalid Input
- Pressure:
  Testing: bloodPressure() function
  - Systolic:
    - Input: 231=Output: Invalid Input
    - Input: -1 =Output: Invalid Input
  - Diastolic
    - Input 151 =Output: Invalid Input
    - Input: -1 =Output: Invalid Input

Monitoring: Equivalence Testing

Testing: alertLevel() function

- Input: Highest levels for all 3, Output: Displays Pulse alarm
- Input: Highest levels for Oxygen and Pressure, Output: Displays Oxygen alarm
- Input: Highest levels for Pulse and Pressure, Output: Displays Pulse alarm

Similar test for all the levels.

Resources:

- Requirements Document – For project description and requirements.
- Microsoft Word – For writing the test plan.
- Visual Studio Code – For developing the code.
- Google – For researching and help with coding.
- Slides – For referencing how to create test plan.

Timeline:

- 09/24 – 10/09 Coding

- 10/10 – 10/16 Coding, Test plan

- 10/16 – 10/23 Coding, Test Plan: Inputs, Frequency, Alerts, Time

- 10/23 – 10/30 Coding, Test Plan: Data, Bad Data, Monitoring, Oxygen

Risks:

- Run out of time
    - Focus on main functionality parts first to have a working project to turn in.
    - Focus on main parts of test plan to have a decent test plan to turn in.
- Stuck on implementing some requirements
    - Research using Google to try and implement.
    - Make sure program works without them and come back to implement if I have time.
- Too much testing
    - Design test plan to minimize duplicate testing and stick to it.
- Too little testing
    - Design test plan to cover all requirements so nothing is missed.
- Focused on less important parts compared to important parts
    - Identify major parts of development and work on them first.
- Misunderstanding requirements
    - Read through requirements thoroughly to understand
    - If developed a part wrong adapt it to make it pass the requirement
    - If developed a part wrong and cant adapt it, delete it and start over.

Boundary Testing Cases Alerts:

Testing Pulse:

- Input: -1 =Output: Invalid
- Input: 0 = Output: Highest alert
- Input: 1 = Output: Highest alert
- Input: 19 = Output: Highest alert
- Input: 20 = Output: Medium alert
- Input: 21 = Output: Medium alert
- Input: 39 = Output: Medium alert
- Input: 40 = Output: None
- Input: 41 = Output: None
- Input: 109 = Output: None
- Input: 110 = Output: Low alert
- Input: 111 = Output: Low alert
- Input: 129 = Output: Low alert
- Input: 130 = Output: Low alert
- Input: 131 = Output: Medium alert
- Input: 169 = Output: Medium alert
- Input: 170 = Output: Medium alert
- Input: 171 = Output: Highest alert
- Input: 209 = Output: Highest alert
- Input: 210 = Output: Highest alert
- Input: 211 = Output: Invalid

Testing Oxygen:

- Input: -1 = Output: Invalid
- Input: 0 = Output: Invalid
- Input: 1 = Output: Highest (based off moving average of last 6 readings)
- Input: 49 = Output: Highest (based off moving average of last 6 readings)
- Input: 50 = Output: Highest (based off moving average of last 6 readings)
- Input: 51 = Output: Medium (based off moving average of last 6 readings)
- Input: 79 = Output: Medium (based off moving average of last 6 readings)
- Input: 80 = Output: Low (based off moving average of last 6 readings)
- Input: 81 = Output: Low (based off moving average of last 6 readings)
- Input: 84 = Output: Low (based off moving average of last 6 readings)
- Input: 85 = Output: No alert
- Input: 86 = Output: No alert
- Input: 99 = Output: No alert
- Input: 100 = Output: Invalid
- Input: 101 = Output: Invalid

Testing Pressure:

- Systolic
    - Input: 231 = Output: Invalid
    - Input: 230 = Output: Medium alarm
    - Input: 229 = Output: Medium alarm
    - Input: 201 = Output: Medium alarm
    - Input: 200 = Output: Low alarm
    - Input: 199 = Output: Low alarm
    - Input: 151 = Output: Low alarm
    - Input: 150 = Output: None
    - Input: 149 = Output: None
    - Input: 71 = Output: None
    - Input: 70 = Output: None
    - Input: 69 = Output: Medium alarm
    - Input: 51 = Output: Medium alarm
    - Input: 50 = Output: Medium alarm
    - Input: 49 = Output: Highest alarm
    - Input: 1 = Output: Highest alarm
    - Input: 0 = Output: Highest alarm
    - Input: -1 = Output: Invalid
- Diastolic
    - Input: 151 = Output: Invalid

- Input: 150 = Output: Medium alarm
- Input: 149 = Output: Medium alarm
- Input: 121 = Output: Medium alarm
- Input: 120 = Output: Low alarm
- Input: 119 = Output: Low alarm
- Input: 91 = Output: Low alarm
- Input: 90 = Output: None
- Input: 89 = Output: None
- Input: 41 = Output: None
- Input: 40 = Output: None
- Input: 39 = Output: Medium alarm
- Input: 34 = Output: Medium alarm
- Input: 33 = Output: Medium alarm
- Input: 32 = Output: Highest alarm
- Input: 1 = Output: Highest alarm
- Input: 0 = Output: Highest alarm
- Input: -1 = Output: Invalid