

Course code and name:	F28HS – Hardware-Software Interface
Type of assessment:	Group
Coursework Title:	System Programming – Mastermind game
Student Name:	Akshay Arunkumar Garg
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Date: 29/03/2022

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Student Name:	Vidisha Jain
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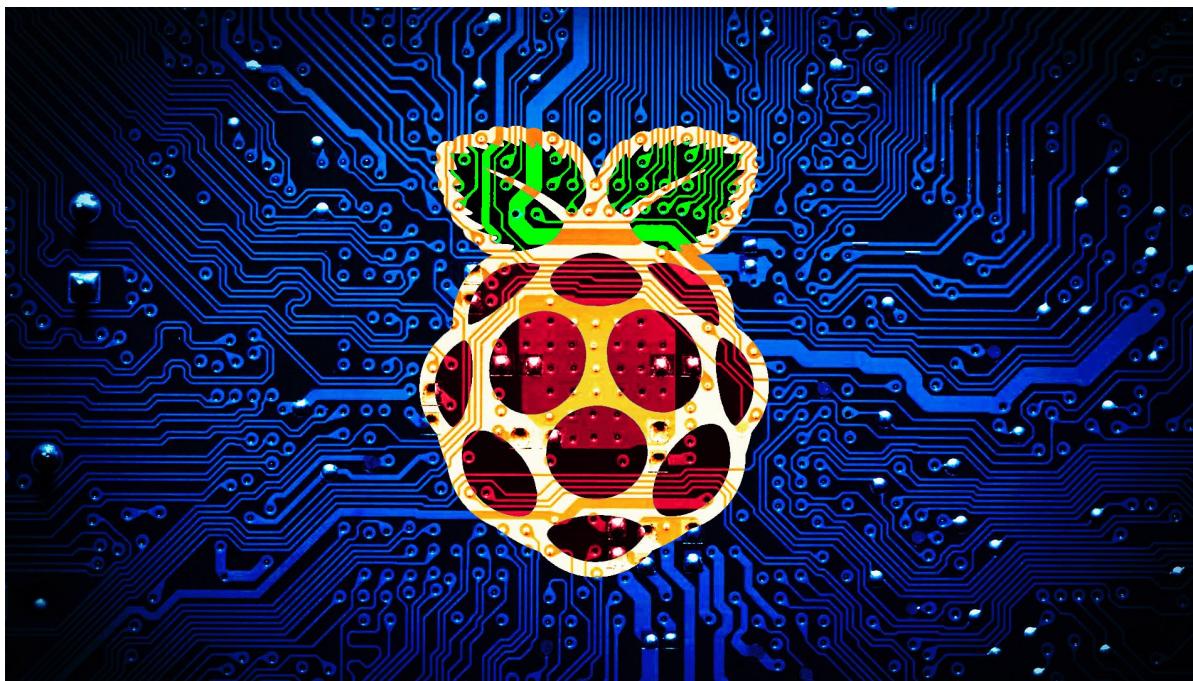
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Date: 29/03/2022

System Programming



Prepared by:
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Vidisha Jain (H00357945)

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Programme:
BSc Computer Science (AI)

Course :
Hardware – Software Interface(F28HS)

Campus:
Dubai

COURSEWORK SPECIFICATION

This is our coursework 2 of course Hardware-Software Interface in which we must develop the mastermind game using the raspberry pi. The languages we must use in this coursework is C language and ARM Assembly Language to develop the game.

HARDWARE SPECIFICATION

In this coursework we have used raspberry pi and the 16GB SD card for the operating system and storing our code. We have used 2 LEDs (red and green colour) and a button to send input from the setup to the raspberry pi. The red colour LED is used to specify when the input is over, or the round is over. Whereas green colour LED is used to show how many times the button is pressed and the count of the exact and approximate match in the sequence. We have used a breadboard to connect the LEDs, buttons, and registers.

CODE STRUCTURE

In the code we have tried to implement the code which is easy to understand and is reusable. Starting with main function we have different mode in the main function which can be used to test the game without using the raspberry pi. In the unit testing mode, we are passing the secret code and the guess code which are used to count the approximate and the exact occurrence of the number in the sequences. When we execute the code without any mode then the game starts, and it shows that the game is started. Then there are three rounds available for the user in which he can guess the secret code. When the round starts, the code asks the user to give input using the button and the counter variable counts the at how many times the button is pressed. After this the guessed code is evaluated and function is called to match the sequence. If the guessed sequence is same as the secret sequence, then we are breaking the loop and printing that the user wins the game. We have tried our best to convert codes into function so that we can reuse them.

FUNCTIONS ACCESSING HARDWARE

There are many functions that are directly connected to hardware (raspberry pi), and they are used to carry out various functions like turning on an LED, getting input from a button and much more with the help of the hardware.

The functions are:

1. **pinMode()** – This function is implemented using inline ARM Assembly code and we are using this function to set the mode of the LED's and the button connected to the raspberry pi using the fSel and shift values calculated.
2. **writeLED()** – This function is implemented using C and the ARM Assembly. We are using this function to turn ON or OFF the LED according to the value passed in the parameter.
3. **readButton()** – This function is implemented using ARM Assembly and we are using this function to check whether the button is clicked or not. If the button is clicked, then the function return a value other than 0 else it returns the value 0.

DEBUG MODE

```
pi@raspberrypi:~/Documents/labs $ gcc -o mastermind mastermind.c
pi@raspberrypi:~/Documents/labs $ sudo ./mastermind -d
Starting Game

The value of sequence is : 112.
The length of the secret code is : 3.
Starting The Round 1
----Starting guess 1----
----End of guess 1----

You have pressed button 1 times.
----Starting guess 2----
---- Button Pressed ----
----End of guess 2----

You have pressed button 1 times.
----Starting guess 3----
---- Button Pressed ----
---- Button Pressed ----
---- Button Pressed ----
----End of guess 3----

You have pressed button 3 times.
The value of sequence is : 113.
Exact Matches are      : 2
Approx. Matches are    : 0
End of The Round 1
Starting The Round 2
----Starting guess 1----
----End of guess 1----

You have pressed button 1 times.
----Starting guess 2----
---- Button Pressed ----
---- Button Pressed ----
----End of guess 2----

You have pressed button 2 times.
----Starting guess 3----
---- Button Pressed ----
---- Button Pressed ----
---- Button Pressed ----
----End of guess 3----

You have pressed button 3 times.
The value of sequence is : 123.
Exact Matches are      : 1
Approx. Matches are    : 1
End of The Round 2
Starting The Round 3
----Starting guess 1----
---- Button Pressed ----
---- Button Pressed ----
---- Button Pressed ----
----End of guess 1----
```

SUMMARY

This coursework helped us in learning and implementing concepts of programming in C language and ARM Assembly language. Also, we learnt how to write inline Arm assembly code in C language. We were able to develop the master mind game using these both languages. But we were not able to create the ARM Assembly code for the count matches function which counts the exact and the approximate number in the sequence. The additional features which we added to the code is that if the user doesn't give input then we are taking the count as one and continuing the system.