TI-RSLK MAX

Texas Instruments Robotics System Learning Kit

Texas Instruments

Module 7

Quiz: Finite State Machines

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Q1 Pointers and Strings

Write a function that compares two null-terminated strings. Pointers to two strings are passed by reference into the function. The return parameter will be 0 if the strings do not match, and will be nonzero if the strings match. The prototype is

```
int StringCompare(char *pt1, char *pt2);
```

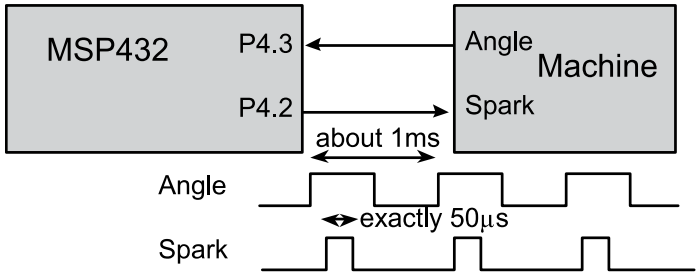
Q2 Arrays and Indexing

Write a function that calculates the dot-product of two arrays. Each array has ten 32-bit signed integers. The prototype is

```
int32_t DotProduct(int32_t buf1[10], int32_t buf2[10]);
```

Q3 Finite State Machine

Design a microcomputer-based controller using a linked list finite state machine. The system has one input and one output.



The input, **Angle**, is a periodic signal with a frequency of 20 to 1000 Hz (has a period of 1 to 50 ms). The output, **Spark**, should be a positive pulse (exactly 50 µs wide) every time **Angle** goes from 0 to 1. The delay between the rising edge of **Angle** and the start of the **Spark** pulse should be as short as possible. The period of **Angle** can vary from 1 ms to 50 ms. Since **Angle** is an input you cannot control it, only respond to its rising edge.

a) Design the one input, one output finite state machine for this system. Draw the state transition graph. Use descriptive state names.
b) Show the C code to create the statically-allocated linked list. Include statement(s) to place it in ROM on your microcomputer.
c) Show the C language controller. The controller can have no conditional statements (no **`if`**, no **`switch`**, no conditional operator). Assume this is the only task that the microcomputer executes. I.e., show ALL the instructions necessary. Make the program automatically start on a RESET. You may call functions in **Clock.c**.

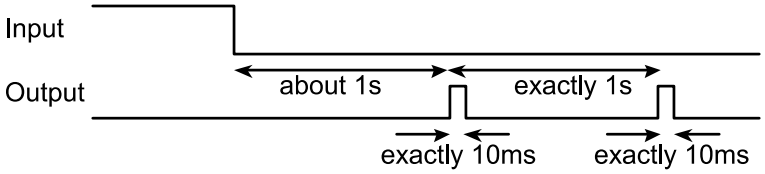
Q4 Finite State Machine

Design a FSM with two inputs and two outputs. The inputs are on Port 4 bits 0,1 and the outputs are on Port 5 bits 0,1. Initially the output is 00. You may also assume both inputs are initially 0. The machine waits for the first input to become 1. If P4.1 goes high first, set the output to 10. If P4.0 goes high first, the output goes to 01. If both inputs go high at the same time, the output goes to 11.

a) Design the two input, two output finite state machine for this system. Draw the state transition graph. Use descriptive state names
b) Show the C code to create the statically-allocated linked list. Implement next states as pointers, Include statement(s) to place it in ROM on your microcomputer.
c) Show the C language controller. The controller can have no conditional statements (no **`if`**, no **`switch`**, no conditional operator ?) Assume this is the only task that the microcomputer executes. I.e., show ALL the instructions necessary. Make the program automatically start on a RESET. You may call functions in **Clock.c**.

Q5 Finite State Machine

You will design a pacemaker using a Moore FSM. There is one input and one output. The input will be high if the heart is beating on its own. The input will be low if the heart is not beating on its own. If the heart is not beating your machine should pace the heart. If the heart is beating on its own, the input will be high and your output should be low. However, if the input is low, you should pace the heart by giving a 10 ms output pulse every 1000 ms. P4.0 is output, P4.1 is input.



a) Design the one input, one output finite state machine for this system. Draw the state transition graph. Use descriptive state names
b) Show the C code to create the statically-allocated linked list. Implement next states as indices. Include statement(s) to place it in ROM on your microcomputer.
c) Show the C language controller. The controller can have no conditional statements (no **`if`**, no **`switch`**, no conditional operator). Assume this is the only task that the microcomputer executes. I.e., show ALL the instructions necessary. Make the program automatically start on a RESET. You may call functions in **Clock.c**.

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