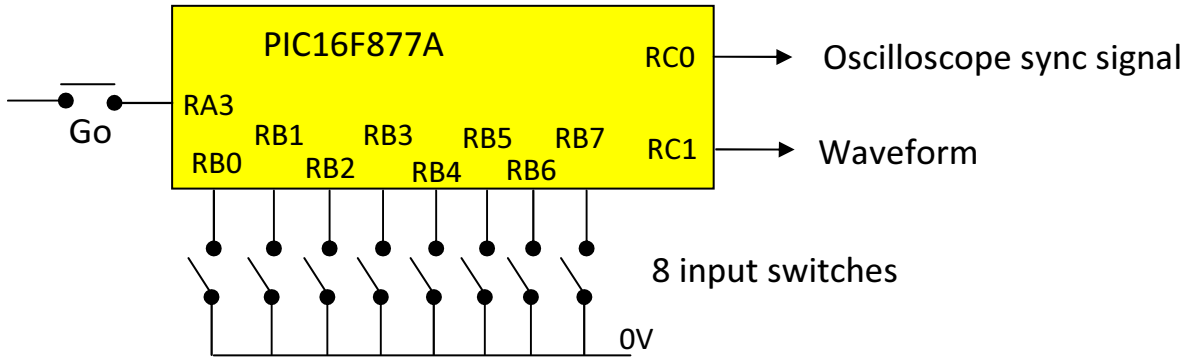
Electrical, Electronic & Computer Engineering
School of Engineering & Physical Sciences

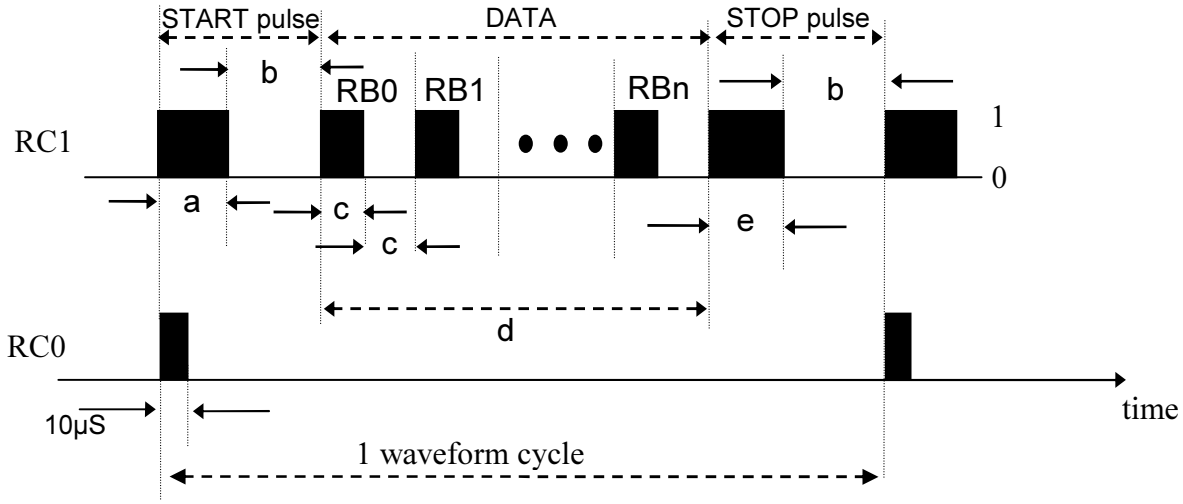
B31DD1 : Embedded systems :: Assignment 2.

Problem

A PIC16F877A (40 pin version of PIC16F84A) device is required to generate a specialised repetitive timing waveform for a piece of test equipment. The system has the following hardware structure



Two output lines from PORT C produce signals of the form :



1. The waveform consists of a repeating set of cycles. Waveforms are generated as long as the GO button is pressed.
2. A cycle begins with a START pulse, continues with a set of data pulses and completes with a STOP pulse.
3. The data pulses correspond to the values of the switches connected to PORT B.
4. In each cycle, the state of between 4 and 8 switches are output to RC1 as a serial stream of signals.
    a. The number of switches scanned and output will be between 4 and 8. If '4' then RB0 to RB3 are to the scanned and output; if '5' then RB0 to RB4 are to the scanned and output; etc.
    b. If switch RBn is a logic '1' then output a pulse 'c' times high followed by 'c' times low.
    c. If switch RBn is a logic '0' then output a low for '2*c' time.

5. The signal from RC0 is used to trigger an oscilloscope display and should be 10µS.

The parameters for the above waveform are :

Parameter	Description	Range	Steps
a	Width of START pulse high time	1mS → 5mS	500µS
b	Width of START pulse low time and width of STOP pulse low time	1mS → 5mS	500µS
c	Width of a data '1' pulse	100µS → 400µS	50µS
d	Number of switches to be checked	4 → 8	1
e	Width of STOP pulse high time	1mS → 5mS	500µS

Each student will be given ONE set of parameters from the table at the end of this document.

Task 1

- Write a PIC assembly language program to implement the above problem on a PIC16F877a microcontroller. Show it running as a Proteus simulation. Assume a 20MHz clock.

Task 2

- Run the PIC code on a PIC Brick unit with a PIC16F877a microcontroller.
- At the test time you may be asked to change ANY of the five parameters (a, b, c, d or e). Therefore, you should design you program to make this as easy as possible.

Task 3

- Submit a fully documented code listing of your program at the test time (stapled).

Notes

- Student will work as individuals.
- Students will use the Proteus package and the MPLAB package. Both are available on the University computer network under "EPS programs".
- Switches on "red box" units in the lab have pull-up resistors. You will require to insert pull-up resistors in your Proteus simulation.
- A user guide to MPLAB is available in the "User Guides" section of Vision.
- MPLAB is also available as a free download from the Microchip website (www.microchip.com) and can be run on your own machines.
- For hardware testing connect RC0 to oscilloscope channel 0 and RC1 to oscilloscope channel 1, then set oscilloscope to trigger on channel 0. This will allow the oscilloscope to show a stable waveform.
- Test days :: Wednesday 4th and Friday 6th November (Semester week 8)
- Marks will be allocated as follows
    - Proteus test : 30%
    - PIC test : 30%
    - Commented listing : 40%
        - Reviewed for quality of the design and code layout
        - Documented listing (very important) MUST be submitted at the time of the test on the PIC hardware and be stapled.
        - Marking of the commented listing will be EXCEPTIONALLY severe!

Table of allocated parameters

Allocation Number	a	b	c	d	e
1	1.0	3.5	100	8	5.0
2	1.5	4.0	150	7	5.5
3	2.0	4.5	200	6	4.0
4	2.5	5.0	250	5	3.5
5	3.0	1.0	300	4	3.0
6	3.5	1.5	350	8	2.5
7	4.0	2.0	400	7	2.0
8	4.5	2.5	100	6	1.5
9	5.0	3.0	150	5	1.0
10	1.0	3.5	200	4	5.0
11	1.5	4.0	250	8	4.5
12	2.0	4.5	300	7	4.0
13	2.5	5.0	350	6	3.5
14	3.0	1.0	400	5	3.0
15	3.5	1.5	100	4	2.5
16	4.0	2.0	150	8	2.0
17	4.5	2.5	200	7	1.5
18	5.0	3.0	250	6	1.0
19	1.0	3.5	300	5	5.0
20	1.5	4.0	350	4	4.5
21	2.0	4.5	400	8	4.0
22	2.5	5.0	100	7	3.5
23	3.0	1.0	150	6	3.0
24	3.5	1.5	200	5	2.5
25	4.0	2.0	250	4	2.0
26	4.5	2.5	300	8	1.5
27	5.0	3.0	350	7	1.0
28	1.0	3.5	400	6	5.0
29	1.5	4.0	100	5	4.5
30	2.0	4.5	150	4	4.0
31	2.5	5.0	200	8	3.5
32	3.0	1.0	250	7	3.0
33	3.5	1.5	300	6	2.5
34	4.0	2.0	350	5	2.0
35	4.5	2.5	400	4	1.5
36	5.0	3.5	100	8	1.0
37	1.0	4.0	150	7	5.0
38	1.5	4.5	200	6	4.5
39	2.0	5.0	250	5	4.0
40	2.5	1.0	300	4	3.5
41	3.0	1.5	350	8	3.0
42	3.5	2.0	400	7	2.5
43	4.0	2.5	100	6	2.0
44	4.5	3.0	150	5	1.5
45	5.0	3.5	200	4	1.0

Student Parameter allocation

Surname	First name	Parameter allocation number
Al.tabet	Mohamed	20
Barthèlemy	Anaïs	21
Chedburn	Robbie	22
Colville	Mark	23
Craig	Cameron	24
da Rocha	Fabio	25
de Oliveira	Danielle	26
Dmuhovskis	Andrejs	27
Duncan	Siobhan	28
Dunlop	Rory	29
Evans	Gareth	30
Eyre	Lauren	31
Ferguson	David	32
Fernandes	Livia	33
Fyvie	Derek	34
Gallagher	Aidan	35
Hamilton	Lee	36
Ivanovs	Pavels	37
KHADAS	WAQAR	38
Korch	Andrej	39
Laing	Samuel	40
Lampert	Markus	41
Mammadov	Samir	42
McColl	William	43
McPake	Connor	44
McRobert	Kyle	45
Mitchell	Roshenac	1
Murray	Jamie	2
Mutch	Euan	3
Nazir	Sakib	4
Nurgaliyev	Shakh-izat	5
Penman	Rhys	6
Rigg	Andrew	7
Robertson	Duncan	8
Saleem	Adeel	9
Sardinha	Hugo	10
Sheikh	Afiyah	11
Shek	Liam	12
Stilo	Lorenzo	13
Strutt	Adam	14
Taghinia	Keivan	15
Thain	Stuart	16
Vidal-Dhô	Matthias	17

Number refers to entry in table on page 3.