

MORGAN WILLIAMS

WZL 19848902

Question 1:

A) An ALU is a arithmetic logic unit, ALU'S allow computers to carry out mathematical processes with binary.

Program counters are used to check what the next instruction is in a program and gives an address where it is stored in the memory.

In PIC TRISB sets the port direction which can read/write port pin values.

B) Some ASM commands may take longer to execute than others because some of the memory files that you may try to access can be larger than others.

C) RISC stands for reduced instruction set computing. It is generally better for small but highly optimised sets of instructions which have to happen quickly which means it is worse than CISC for complicated tasks.

D) I would use assembly language over C/C++ in a time critical process simply due to the fact it is quicker.

MORGAN WILLIAMS

WIL 19848902

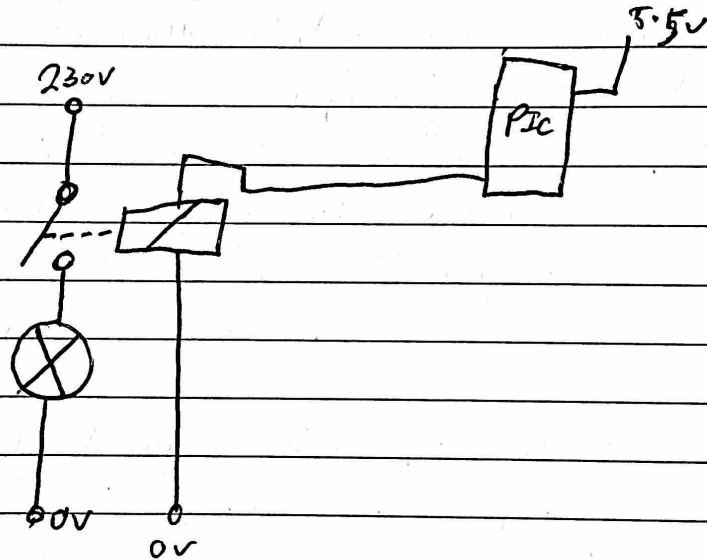
Question 2:

- A) A Processor stack is a memory usage device which will allow the memory to be used as temporary storage for a program. A use could be for when a interrupt routine is called and the position of the program is then stored on the stack using a p-stack pointer.
- B) One of the main reasons why Sub-routines are used in a program is to help break down the program which not only makes it easier to fault find on but also faster. This can be achieved by taking out repeating code and putting it into a Sub-routine which runs it when it's called. Sub-routines can also allow for easy changing of parameters to the program without the risk of altering the main program as they are stored separately from the main program.
- C) If an external hardware interrupt occurs on a PIC16F84 it will pause the main program in the program stack and use a stack pointer to remember the last location of the program. It will then run the Interrupt Sub-routine until it is finished. After the interrupt routine has been completed it will then find the last location of the program in the stack using the pointer and load up and carry on with the program.

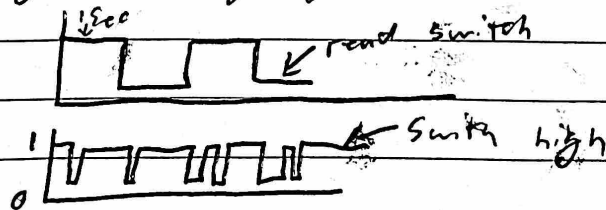
Question 3:

A) One of the main limitations of connecting loads to the output of a PIC16F84A is that it only outputs DC current so AC current devices will not work on it. Also it only outputs a small amount of current (25mA) so would not be able to power devices with a power draw greater than 25mA.

B) One method of allowing a PIC device to control the on off state of a 230V ac mains operated load would be to use a relay.



C) One issue which can arise from connecting a mechanical switch to a processor is that the mechanical switches can bounce causing contact in the switch to be lost sending a unclear signal. This can be solved by using a polling system where switch is read once per cycle.



MORGAN WILLIAMS

WEL19848902

Question 3

D) Number of Levels = $2^{12} - 1$

$$= 4096 - 1$$

$$= 4095 \text{ Levels}$$

$$\text{Value of each step} = \frac{10}{4095} = \frac{2}{819}$$

$$\frac{65}{\left(\frac{2}{819}\right)} = \frac{10647}{4} = 2661.75 = 2662$$

2048	1024	512	256	128	64	32	16	8	4	2	1
1	0	1	0	0	1	1	0	0	1	1	0

$2662 - 2048 =$	614
$614 - 512 =$	102
$102 - 64 =$	38
$38 - 32 =$	6
$6 - 4 =$	2
$2 - 2 =$	0

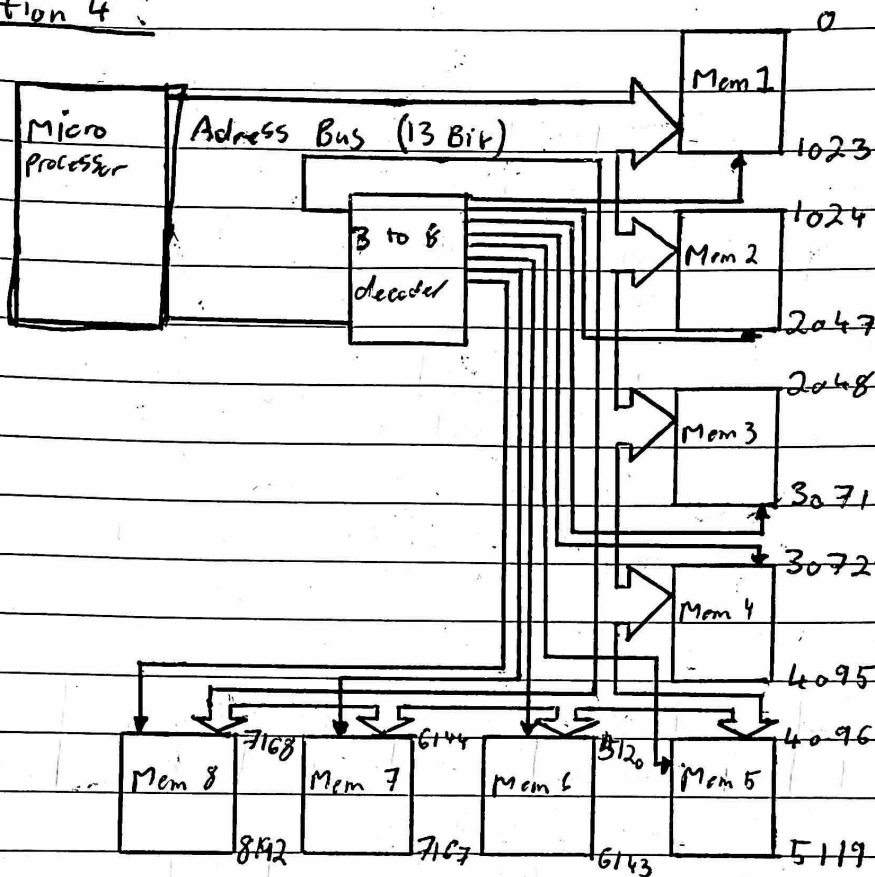
~~8~~	~~4~~	~~2~~	~~1~~	~~8~~	~~4~~	~~2~~	~~1~~	~~8~~	~~4~~	~~2~~	~~1~~
~~1~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~

~~24~~ ~~6~~ ~~6~~

~~Answer~~

Question 4 :

A)



A_{12}	A_{10}	A_9	8	7	6	5	4	3	2	1
0	0	0	1	1	1	1	1	1	1	0
0	0	1	1	1	1	1	1	1	0	1
0	1	0	1	1	1	1	1	0	1	1
0	1	1	1	1	1	1	0	1	1	1
1	0	0	1	1	1	0	1	1	1	1
1	0	1	1	1	0	1	1	1	1	1
1	1	0	1	0	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1	1

B) $4699 - 4096 = \text{location } 603 \text{ in Mem 5}$

1024	512	256	128	64	32	16	8	4	2	1
0	1	0	0	1	0	1	1	0	1	1

MORGAN WILLIAMS

WIL 9984 8902

Question 4

c) One of the main differences between Von-Neuman and Harvard memory architecture is that HARVARD stores machine instructions and data in separate memory units whereas with Von-Neuman they are stored together. HARVARD machines can better run a program and access data simultaneously whereas Von-Neuman instructions are fetched and then run one at a time during operation.

Question 5

A) Direct memory access allows for I/O (input/output) devices to send/receive data directly from the memory bypassing the processor. The three main modes of DMA are burst cycle, cycle steal/single byte and transparent/hidden mode. Burst cycle is the fastest type of DMA which will send a hold signal to the processor and will then take control of the system bus. Cycle/steal mode only one byte is transferred at a time whereas burst sends many bytes at a time. Steal mode also sends a hold signal to the processor. Transparent mode is the slowest form of DMA due to the fact that it allows the processor to carry out some operations.

B) ~~Synchronous transmissions are characterized by the synchronization of~~
In Synchronous transmissions, data is sent in the form of blocks/frames. It is a full duplex form of data transmissions.
In Asynchronous transmissions, the signal is half duplex as data is sent in the form of one byte/character.

C) SPI is a four wire based full duplex comms protocol whereas I²C is a two wire based protocol. One advantage of SPI interface is that it is faster than I²C and has no complex slave addressing systems but has the potential to have more complex wiring if multiple slaves are added.

D) A start signal on I²C is indicated by pulling the SDA low whilst SCL line is high. Once 8 bits of data have been sent an ACK signal will be sent and a stop signal is sent by the master taking the SDA from low to high when the SCL is high.