**Question 1**. What is the range of voltages that represent logic low?

**Question 2**. What is the range of voltages that represent logic high?

**Question 3**. What is the difference between positive and negative logic?

**Question 4**. What is the difference between volatile and nonvolatile memory?

**Question 5**. What is flash?

**Question 6**. What is a pin? What is a port?

**Question 7**. What does real-time mean?

**Question 8**. How much RAM and ROM does our microcontroller have?

**Question9.How do we change the following Program to run using Port A(set** PA7 out**)?**

void PortF\_Init(void){ volatile unsigned long delay;

  SYSCTL\_RCGC2\_R |= 0x00000020;     // 1) activate clock for Port F

  delay = SYSCTL\_RCGC2\_R;           // allow time for clock to start

  GPIO\_PORTF\_LOCK\_R = 0x4C4F434B;   // 2) unlock GPIO Port F

  GPIO\_PORTF\_CR\_R = 0x1F;           // allow changes to PF4-0

  // only PF0 needs to be unlocked, other bits can't be locked

  GPIO\_PORTF\_AMSEL\_R = 0x00;        // 3) disable analog on PF

  GPIO\_PORTF\_PCTL\_R = 0x00000000;   // 4) PCTL GPIO on PF4-0

  GPIO\_PORTF\_DIR\_R = 0x0E;          // 5) PF4,PF0 in, PF3-1 out

  GPIO\_PORTF\_AFSEL\_R = 0x00;        // 6) disable alt funct on PF7-0

  GPIO\_PORTF\_PUR\_R = 0x11;          // enable pull-up on PF0 and PF4

  GPIO\_PORTF\_DEN\_R = 0x1F;          // 7) enable digital I/O on PF4-0

}

**Question10**. The base address for Port A is 0x4000.4000. If we want to read and write all 8 bits of this port, the constants will add up to 0x03FC. In other words, read and write operations to GPIO\_PORTA\_DATA\_R will access all 8 bits of Port A. If we are interested in just bit 5 of Port A, address for Port PA5, how we define this in C and in assembly? If we define PA5 as bit address, does the following code modify the other 7 bits of Port A?

For example: PA5 = 0x20;       // make PA5 high

**Question11**. Assume an LED is attached to Port F bit 2. Write toggle the LED operations in C and in assembly will create a bit-specific address constant to access just PF2.

**Answer 1**. 0.0 to 1.155V is logic low

**Answer 2**. A voltage between 2.145 and 5 V is considered high

**Answer 3**. Positive means the true state has higher voltage than the false state. Negative logic means the true state has lower voltage than the false state

**Answer 4**. Volatile memory loses its information when power is removed and then restored. Nonvolatile memory retains its information when power is removed and then restored.

**Answer 5**. Flash is a type of EEPROM (electrically erasable programmable read only memory)

**Answer 6**. A pin is a wire connecting the real world. A port is a collection of pins grouped by common function.

**Answer 7**. Real-time means the system responds to events in a time always less than the desired amount. Latency is the response time between the arrival of an event and the completion of the software response to that event. A real-time system as a latency always less than a small bound.

**Answer 8**. The TM4C123 has 32 kibibytes of RAM and 256 kibibytes of ROM

Answer 9

SYSCTL\_RCGC2\_R |= 0x00000001;     // 1) activate clock for Port A

  delay = SYSCTL\_RCGC2\_R;           // allow time for clock to start

  GPIO\_PORTA\_AMSEL\_R &= ~0x80;      // 3) disable analog on PA7

  GPIO\_PORTA\_PCTL\_R &= ~0xF0000000; // 4) PCTL GPIO on PA7

  GPIO\_PORTA\_DIR\_R |= 0x80;         // 5) PA7 out

  GPIO\_PORTA\_AFSEL\_R &= ~0x80;      // 6) disable alt funct on PA7

  GPIO\_PORTA\_DEN\_R |= 0x80;         // 7) enable digital I/O on PA7

Answer10:

we add 0x0080 to 0x4000.4000, and we can define this in C and in assembly as

#define PA5   (\*((volatile unsigned long \*)0x40004080))

in assembly:

PA5 EQU 0x40004080

it does not modify the other 7 bits of Port A.

Answer11:

|  |  |
| --- | --- |
| PF2 EQU 0x40025010  Toggle    LDR R1, =PF2    LDR R0, [R1]    EOR R0, R0, #0x04    STR R0, [R1]    BX  LR | #define PF2 (\*((volatile unsigned long \*)0x40025010))  void Toggle(void){    PF2 ^= 0x04;  // toggle LED  } |