

1. Single-choice problems (5 points each)

1.1. In a 2's complement system, which of the follow one indicates an overflow?

- A. $N + P = N$
- B. $N + N = P$
- C. $P + P = P$
- D. $N + N = N$

1.2. What is the crystal frequency of the Arduino Uno board?

- A. 16.6 MHz
- B. 160 MHz
- C. 16 MHz
- D. 8 MHz

1.3. What is a typical value for a pull-up resistor?

- A. 100 Ohm
- B. 10 Ohm
- C. 10k Ohm
- D. 5 Ohm

1.4. What is the assembly instruction that sets a particular bit in a register?

- A. CBI
- B. SBI
- C. SBIC
- D. BRNZ

1.5. Which of the following instruction adds 1 to R16?

- A. IN R16, PINB
- B. INC R16
- C. DEC R16
- D. LDI R16, 0x01

2. Multiple choice problems (5 points each)

2.1. What are the components to form a "Device" in Eagle PCB's library?

- A. Schematic
- B. Symbol
- C. Footprint
- D. Layout

2.2. Which of the following memories are volatile?

- A. EEPROM
- B. ROM
- C. DRAM
- D. SRAM

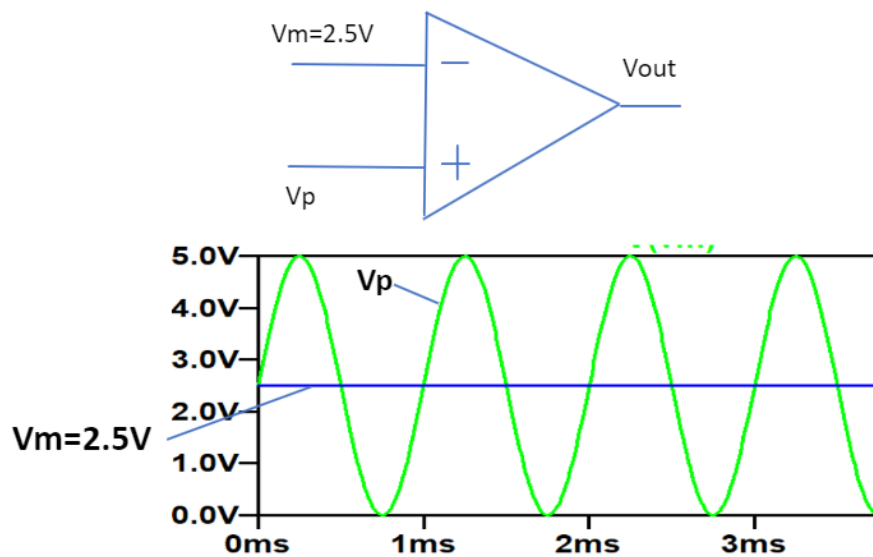
2.3. Which ones of the following instructions are correct as a C code for microcontrollers?

- A. `A+=1`
- B. `A=+1`
- C. `A=++1`
- D. `A+=11`

2.4. Which of the following instructions are resulting in a 5 in R16?

- A. `LDI R16, 4`
`LDI R17, 1`
`ADD R16, R17`
- B. `LDI R16, 4`
`LDI R17, 1`
`ADD R17, R16`
- C. `LDI R16, 4`
`INC R16`
- D. `LDI R16, 4`
`DEC R16`

3. The following comparator is used to build the robot car in this class. Draw the comparator's output in the diagram. (10 points)



4. An LED is connected to each pin of PORTD. Write an assembly program to turn on PORTD 0 ~ 5. (10 points)

5. Write an assembly program that when R20 == R21, R22 increases by 1. (10 points)

6. Convert the following C program into assembly. (10 points)

```
int main()
{
    R10 = 5;
    if (R20 == R21)
        R22++;
    else
        R22--;
    R17++;
}
```

7. Write a C program to debounce a pushbutton that is connected to digital I/O pin 5. For each push, add 1 to a counter and display it in the serial monitor. (10 points)

EE3233 HW6, 100 points in total

8. Write a C program to set PORTD to output and then toggle every bit in PORTD every 1 s. (5 points)