

# HW9: Bitwise operators and bitmasks

## (CS220-04)

For problems 1 through 4, find the 8 bit result from applying (a) AND, (b) OR and (c) XOR of the two bit patterns shown.

1)

(a)

```

      0 1 0 1 1 0 1 1
AND  1 1 0 0 1 0 0 1
-----
      0 1 0 0 1 0 0 1

```

(b)

```

      0 1 0 1 1 0 1 1
OR   1 1 0 0 1 0 0 1
-----
      1 1 0 1 1 0 1 1

```

(c)

```

      0 1 0 1 1 0 1 1
XOR  1 1 0 0 1 0 0 1
-----
      1 0 0 1 0 0 1 0

```

2)

(a)

```

      1 1 0 0 1 0 0 1
AND  1 1 1 0 0 1 1 0
-----
      1 1 0 0 0 0 0 0

```

(b)

```

      1 1 0 0 1 0 0 1
OR   1 1 1 0 0 1 1 0
-----
      1 1 1 0 1 1 1 1

```

(c)

```

      1 1 0 0 1 0 0 1
XOR  1 1 1 0 0 1 1 0
-----
      0 0 1 0 1 1 1 1

```

3)

(a)

```

      1 1 1 0 0 1 1 0
AND  0 1 1 1 1 0 0 0
-----
      0 1 1 0 0 1 0 0

```

(b)

```

      1 1 1 0 0 1 1 0
OR   0 1 1 1 1 0 0 0
-----
      1 1 1 1 1 1 1 0

```

(c)

```

      1 1 1 0 0 1 1 0
XOR  0 1 1 1 1 0 0 0
-----
      1 0 0 1 1 0 1 0

```

4)

(a)

```

      0 1 1 1 1 1 0 0
AND  0 0 0 1 1 1 1 1
-----
      0 0 0 1 1 1 0 0

```

(b)

```

      0 1 1 1 1 1 0 0
OR   0 0 0 1 1 1 1 1
-----
      0 1 1 1 1 1 1 1

```

(c)

```

      0 1 1 1 1 1 0 0
XOR  0 0 0 1 1 1 1 1
-----
      0 1 1 0 0 0 1 1

```

- 5) What is the 8 bit pattern generated by the following expression in C/C++?

$$1 \ll 3 \mid 1 \ll 5$$

$$\begin{aligned} &00001000 \mid \\ &00100000 = \\ &00101000 \end{aligned}$$

- 6) What is the 8 bit pattern generated by the following expression in C/C++?

$$\sim (\sim 0 \ll 5) \ll 2$$

$$\begin{aligned} &11111111 \ll 5 = 11100000 \\ &\sim 11100000 = 00011111 \ll 2 = 01111100 \end{aligned}$$

- 7) What are the 8 bit patterns generated by the following expressions in C/C++?  
(a)

$$\sim 0 \gg 4$$

$$11111111 \gg 4 = 00001111$$

(b)

$$\sim 0 \gg 4$$

$$11111111 \gg 4 = 11111111$$

- 8) Write a C/C++ expression to **GENERATE** a superb bitmask with 1s in bits 2 and 4 and in bits 8--14. This expression should work for any register/word size with at least 15 bits and **MUST NOT** be a primitive hex or similar bitmask.

$$0111 \ 1111 \ 0001 \ 0100$$

$$(1 \ll 2) \mid (1 \ll 7) \mid \sim (\sim 0 \ll 6) \ll 8$$