

# Exam 1 Review

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COSC 208, Introduction to Computer Systems, 2021-09-15

## Announcements

- Exam 1

## Binary arithmetic

Perform the following calculations. Operands are encoded using two's complement encoding with 6 bits. For each calculation, express the result in binary and decimal, and indicate whether the result overflows, underflows, or neither.

Q1:  $0b110000 + 0b111111$

Q2:  $0b001111 + 0b000001$

Q3:  $0b101010 + 0b100100$

Q4:  $0b001000 + 0b011000$

Q5:  $0b110000 + 0b010000$

## Strings

Q10: The following program should ask the user to enter a word, then print the word's length and whether it is a palindrome (i.e., reads the same backward as forward). For example, if the user enters "kayak" the program should print "The word is 5 characters long and is a palindrome." However, the program contains several errors. Modify the program to correct the errors.

```
#include <stdio.h>

void palindrome(char word[]) {
    int i = 0;
    int j = strlen(word);
    while (i < j) {
        if (word[i] != word[j]) {
            return -1;
        }
        i++;
        j--;
    }
    return 1;
}

int main() {
    printf("Enter a word: ");
    char word[50];
    fgets(word, 50, stdin);
    word[strlen(word)-1] = '\0'; // Remove newline
    int len = strlen(word);
    printf("The word is %c characters long and is ", len);
    if (palindrome(word)) {
        printf("a palindrome.\n");
    } else {
        printf("not a palindrome.\n");
    }
}
```

Q11: Write a function called `molecular_formula` that takes a string containing the constituent atoms of a molecule and updates the string to contain the molecular formula. For example, the string `"HHO"` should be changed to `"H2O"`, and the string `"HHSO000"` should be changed to `"H2SO4"`. You can assume:

- Molecules will only contain elements that are represented by a single letter — e.g., a molecule may contain `'H'` but not `"Na"`
- All atoms of the same element are listed consecutively — e.g., the constituent atoms may be provided as `"HHO"` but not `"HOH"`
- The elements are listed in the order they should appear in the molecular formula — e.g., the constituent atoms `"HHO"` are changed to the molecular formula `"H2O"`, whereas the constituent atoms `"OHH"` are changed to the molecular formula `"OH2"`
- There will be at most 9 atoms of each element — e.g., `"H9C9"` may occur, but `"H10C11"` will not occur

## Structs

Q12: Define a struct for representing a chemical element, which includes the element's:

- Name
- Chemical symbol
- Atomic number
- State (solid, liquid, or gas) at room temperature

Q13: Write a function called *lookup* that takes a chemical symbol and an array containing a struct for each of the 118 elements in the periodic table. The function should return the specified element's atomic number. If the provided symbol does not correspond to a known element, the function should return -1.

## Number base conversions

Perform the following conversions

Q14: 97 to 8-bit unsigned binary

Q15: -42 to 8-bit two's complement

Q16: 0b11001100 to unsigned decimal

Q17: 0b11001100 to signed decimal

Q18: 0x27 to unsigned decimal

Q19: 0xDEAD to 16-bit binary