

Name: (as it would appear on official course roster)	
UCSB email address:	@ucsb.edu
Lab Section Time:	
Optional: name you wish to be called if different from above	
Optional: name of "homework buddy" (leaving this blank signifies "I worked alone")	

Homework 07: Numerical Conversions / Structures

Assigned: Tuesday, November 17th, 2020

Due: Monday, November 23rd, 2020 by 11:59 PM

Points: 70 (normalized to 100 in grade book)

- You may collaborate on this homework with AT MOST one person, an optional "homework buddy".
- MAY ONLY BE TURNED IN ON **GRADESCOPE as a PDF file**. Instructions on How to Submit (applicable to ALL homework assignments in this class) are on Piazza.
- There is NO MAKEUP for missed assignments.
- We are strict about enforcing the LATE POLICY for all assignments (see syllabus).
- **IMPORTANT:** If you use code techniques we have NOT covered in class, you will **get a zero grade** on that problem. If you cheat, or have someone else do your work, you will **get an F in the class**.
Only use the space provided for answers. Use clear and clean handwriting (or typing).

Reading:	Numerical Conversions – no reading Structures – Ch. 10.1
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1. (3 pts) You need 1 binary bit to express 2 numbers (i.e. 0 and 1). How many binary bits do you need to express the following (and **show your reasoning why**):
 - a. The eight numbers 0 thru 7?
 - b. The number of lower-case letters in the English language alphabet?
 - c. The number of states in the USA?
2. (2 pts) How many distinct numbers can you express with the following (and say why):
 - a. 5 bits?
 - b. 11 bits?

3. (5 pts) What is the algorithm (you can write it in pseudo-code, don't write it in C++) to convert an integer decimal number into **octal** (base-8)?

4. (10 pts) Apply this algorithm to convert the following decimal numbers into octal:
 - a. **64**

b. **2020**

5. (20 pts) Convert the following hexadecimal numbers into decimal. **SHOW YOUR WORK.**

a. 0x77

b. 0x13B

c. 0xB0E5

d. 0xABCD

6. (20 pts) Convert the following binary numbers into *both* hexadecimal and decimal. **SHOW YOUR WORK.**
- a. **10010**

b. **10010101**

c. **10101111**

d. **11111111** (*hint for a shortcut: $2^{10} = 1024$ and these are 9 1s*)

7. (4 pts) Write a *definition* for a structure type for records consisting of a person's wage rate (dollars per hour), accrued vacation (in whole days), and status (hourly or salaried represented as either 'H' or 'S', respectively). Call the type **EmployeeRecord**.

8. (6 pts) Given the following structures defined:

```
struct Date {  
    int day;  
    int month;  
    int year;  
};
```

```
struct Person {  
    string name;  
    Date dateOfBirth;  
};
```

```
struct ProjectTeam {  
    Person MemberA, MemberB;  
    Person Leader;  
    string projectName;  
    double projectBudget;  
    Date projectDueDate;  
};
```

- If we declare **ProjectTeam TheATeam;** which was then initialized fully and correctly:
- a) (2 pt) How would you print (to std.out) the project budget for **TheATeam**?

- b) (2 pt) How would you print (to std.out) the name of Member B of **TheATeam**?

- c) (2 pt) How would you print (to std.out) the year that the project leader of **TheATeam** was born?