

Practical Discrete Mathematics (CSE 1402)

MINOR ASSIGNMENT-3: NUMBER SYSTEM CONVERSION, COMBINATORICS ORIENTED REAL LIFE PROBLEMS USING SCI-PY

1. Write a Python program that takes a decimal number as input and converts it to its binary, octal, and hexadecimal representations.

Instructions:

- The program should ask the user to input a decimal number.
- Convert the number to binary, octal, and hexadecimal.
- Output all three representations.

2. Write a Python program to convert a binary number to its decimal equivalent. The program should take a binary number as input and return the corresponding decimal value.

Example:

- Input: 1101
- Output: 13

3. Write a Python program that takes a binary number as input and converts it to its octal and hexadecimal equivalents.

Instructions:

- The program should ask the user to input a binary number.
- Convert the binary number to octal and hexadecimal.
- Output the results.

4. Write a Python program that converts a given decimal number to its binary, octal, and hexadecimal equivalents. The program should take an integer as input and output its binary, octal, and hexadecimal representations.

Example:

- Input: 345
- Output:
- Binary: 101011001
- Octal: 531
- Hexadecimal: 159

5. Write a Python program to find the Two's complement representation of a given integer (positive or negative) using an 8-bit representation.

Instructions:

The program should ask the user to input an integer.

If the number is positive, find its binary form.

If the number is negative, compute the Two's complement in 8 bits.

Output the Two's complement.

Customer id	Country	State	Zip code
1	USA	Georgia	30332
2	USA	Georgia	30331
3	USA	Florida	30912
4	Germany	Bavaria	80331
5	India	Karnataka	560001
6	India	Karnataka	569081
7	USA	Florida	30123
8	Canada	Ontario	43134
9	India	Maharastra	578234
10	India	Maharastra	578923

Table 1: Netflix customer dataset

6. • Using the given dataset write a Python program to display the customers who live in the USA and in the state of Georgia using the AND operator. Display the relevant columns: CustomerID, Country, State, City, and Zip Code.

Hint: Use the & (AND) operator to combine conditions for the Country and State columns.

- Using the given dataset write a Python program to display the customers who live either in the USA or in the state of Ontario using the OR operator. Display the relevant columns: CustomerID, Country, State, City, and Zip Code.

Hint: Use the | (OR) operator to combine conditions for Country and State.

- Using the given dataset write a Python program to display the customers who do not live in the USA using the NOT operator. Display the relevant columns: CustomerID, Country, State, City, and Zip Code.

Hint: Use the != (NOT EQUAL) operator to exclude customers from the USA.

- Using the given dataset write a Python program to display the customers who live either in India or in the state of Georgia (USA) using the OR operator. Display the relevant columns: CustomerID, Country, State, City, and Zip Code.

Hint: Use the | (OR) operator to combine conditions for Country and State.

- Using the given dataset write a Python program to display the customers who do not live in India or Germany using the NOT operator. Display the relevant columns: CustomerID, Country, State, City, and Zip Code.

Hint: Use the != (NOT EQUAL) operator to exclude customers from India and Germany.

7. Write a python program that creates a data frame from a dictionary of lists and demonstrates basic operations like displaying data, getting column information, and accessing specific rows.

- Write a python program to filter rows in a DataFrame based on students with an average mark greater than 85.
- Write a python program to handle missing data in a DataFrame by filling missing values or dropping rows/columns that contain NaN.

8. Write a python program to create two data frames and merge those two data frames on a common column.

9. Write a python program to create a data frame of an office with 60 employees and sort the data frame by one or more columns.
10. Write a Python program to:

- Define a list `list1 = [1, 2, 3]` and an integer `int1 = 10`.
- Print the memory addresses of both `list1` and `int1` using the `id()` function.
- Modify the list by appending a new element (`list1.append(4)`) and modify the integer by incrementing it (`int1 += 1`).
- Print the memory addresses again after the modifications.

11. Write a Python program that assigns the numbers 10 and 10 to two different variables `num1` and `num2`.

Check if both variables reference the same memory location using the `id()` function.

Assign two larger integers (e.g., 1000 and 1000) to `num3` and `num4` and check their memory locations.

Explain why small integers might reference the same memory location, but larger integers might not.

12. Write a Python program to retrieve and display the MAC address of the device on which the program is running.

The MAC address should be displayed in two different formats:

Format 1: AA:AA:AA:BB:BB:BB

Format 2: AAAA-AABB-BBBB

13. Use the `uuid` module to fetch the MAC address, then format and display it in the specified formats.

Hint: Use `uuid.getnode()` to retrieve the MAC address as a 48-bit integer.

Format the address appropriately using string manipulation.

14. Write a python program using `scipy` for a restaurant to create meal combos by choosing 3 items from a menu of 10 dishes. How many different meal combos can you offer?

Formula:

$$C(n, k) = \frac{n!}{k!(n - k)!} \quad (1)$$

where,

`n` is the total number of items (10 dishes).

`k` is the number of items to choose (3 items).

15. Write a python program using `scipy` for a problem where in a lottery, you must select 6 numbers from a total of 49. You want to know how many different combinations of 6 numbers can be chosen from 49.

16. Write a python program using scipy for a treasure hunt game for kids provides clues encrypted using a Caesar cipher. One clue reads: "KHOOR ZRUOG", and the kids are told that the letters are shifted by 3 positions.
17. Write a python program using scipy for a traveling salesman who drives around to visit N cities, including his home city, to try to sell his balloons and then return home. He wants to minimize the distance he travels so that his fuel costs are as small as possible.