Example Programs using Strings and Characters

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Objectives

- To program using characters and strings (**GuessBirthday**) (§4.5.1).
- To determine whether the user's input is valid.
- To convert a hexadecimal character to a decimal value (**HexDigit2Dec**) (§4.5.2).
- To revise the lottery program using strings (**LotteryUsingStrings**) (§4.5.3).

Outline

- Discussed
  - The char data type and The Character class
  - The String data type and operations
- Example programs
  - Converting a hexadecimal digits to a decimal
  - Checking valid integer input
  - The guessing birth days game (if time permits)
  - The lottery game (if time permits)
  - Encrypting/Decrypting text (using the Caesar/shift cipher)

Problem 1. Converting Hexadecimal Digits to Decimal

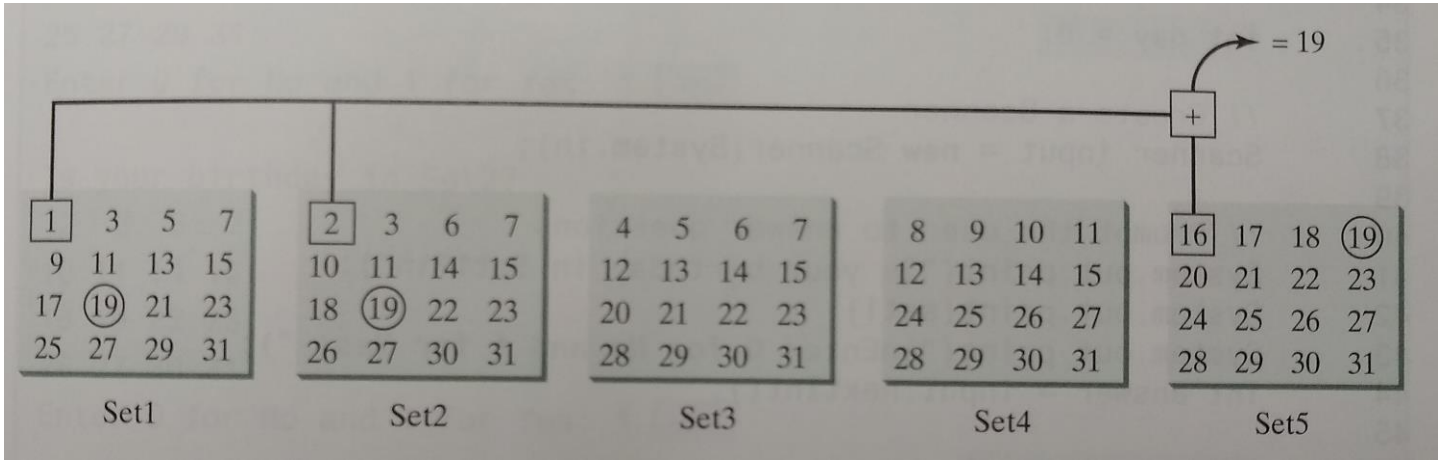
- The hexadecimal number system has 16 digits, 0-9, A-F, representing 0 – 15 in the decimal number system. Write a program that prompts the user to enter a hexadecimal digit and display its decimal value.

Problem 2. Validating Integer Input

- Determine whether the user's input is a valid integer. Here, a valid integer input is defined as a string:
  - Begins with a "+" or "-" sign, or no sign at all.
  - Followed by one or digits
  - Underscore are allowed to separate digits
  - Trailing and leading white spaces are allows
  - While spaces between the sign and the first digit are allowed.

Problem 3. Guess Birthday

- Give 5 sets of numbers below, you can find out the date of the month when your friend is born by asking five questions. Each question asks whether the day is in one of the five sets of numbers.
- The birthday is the sum of the first numbers in the sets where the day appears.



Problem 4. Lottery Game Using Strings

4.5.3 Case Study: Revising the Lottery Program Using Strings

The lottery program in Listing 3.8, Lottery.java, generates a random two-digit number, prompts the user to enter a two-digit number, and determines whether the user wins according to the following rule:

1. If the user input matches the lottery number in the exact order, the award is $10,000.
2. If all the digits in the user input match all the digits in the lottery number, the award is $3,000.
3. If one digit in the user input matches a digit in the lottery number, the award is $1,000.

The program in Listing 3.8 uses an integer to store the number. Listing 4.5 gives a new program that generates a random two-digit string instead of a number, and receives the user input as a string instead of a number.

Problem 4. Text Encryption/Decryption

- To prevent someone from comprehending an intersected text message, we can encrypt it with a key, i.e., transform it to an unintelligible form. We call this process encryption.
  - Plaintext – encryption → ciphertext
  - Encryption: $E(k_e, m_p) \rightarrow m_e$
- Upon receiving the ciphertext, we transform it back to its original form with a key. This is called decryption.
  - Ciphertext – decryption → plaintext
  - Decryption: $D(k_d, m_e) \rightarrow m_p$

Problem 4. Text Encryption/Decryption: Shift Cipher

- The shift cipher is a simple decryption/encryption algorithm, i.e., shift a letter to another with k positions.
- Let's assume k = 3
  - 'a' → 'd'
  - 'b' → 'e'
  - which can be conveniently realized using the modular operator (%).