CS 161A: Programming and Problem Solving I

Discussion 1 Algorithmic Design Document

Make a copy before you begin (File -> Make a copy). The sections will expand as you type. When you are finished, download this document as a PDF (File -> Download -> PDF) and submit to D2L.

This document contains an interactive checklist. To mark an item as complete, click on the box (the entire list will be highlighted), then right click (the clicked box will only be highlighted), and choose the checkmark.

Planning your program before you start coding is part of the development process. In this document you will:

- ☑ ~~Write a detailed description of your program, at least two complete sentences~~
- ☑ ~~If applicable, design a sample run with test input and output~~
- ☑ ~~Identify the program inputs and their data types~~
- ☑ ~~Identify the program outputs and their data types~~
- ☑ ~~Identify any calculations or formulas needed~~
- ☑ ~~Write the algorithmic steps as pseudocode or a flowchart~~
- ☐ Tools for flowchart - Draw.io - Diagrams.net

Program Description

In the box below, describe the purpose of the program. You must include a detailed description with at least two complete sentences.

Program description:
This program will generate a login handle (username) for the user, based on three pieces of user input: first name, last name, and an integer. The final login handle will be the first five letters of the last name, then the first letter of the first name, then the last two digits of the integer. If the last name is less than five characters long, the entire last name will be used without fulfilling the five letter requirement.

Sample Run

If you are designing your own program, you will start with a sample run. Imagine a user is running your program - what will they see? What inputs do you expect, and what will be the outputs from the given inputs? Choose test data you will use to test your algorithm. Calculate and show the expected outputs. Use the sample run to test your algorithm.

Sample run:

```
What is your first name, last name, and an integer (separate each with a space)?

Corinne Fargo 4444

Your username is:

FargoC44
```

Algorithmic Design

Before you begin coding, **you must first plan out the logic** and think about what data you will use to test your program for correctness. All programmers plan before coding - this saves a lot of time and frustration! Use the steps below to identify the inputs and outputs, calculations, and steps needed to solve the problem.

Algorithmic design:

a. Identify and list all of the user input and their data types.

User first name = firstName (string)

User last name = lastName (string)

User number = userNum (integer)

b. Identify and list all of the user output and their data types.

Username = userID (string)

c. What calculations do you need to do to transform inputs into outputs? List all formulas needed, if applicable. If there are no calculations needed, state there are no calculations for this algorithm.

Only one mathematics/modulo calculation, but transformations of input:

1) Identify and assign the first 5 letters of the lastName

```
lastName = lastName.substr(0, 5);
```

If less than 5, same operation but ending at actual lastName size:

lastName = lastName.substr(0, lastName.size());

2) Identify the first 1 letter of the firstName

   firstName = firstName.substr(0, 1);

3) Find the last two digits of userNum, then transform integer to string

   userNum = userNum % 100;

   String sUserNum = to_string(userNum);

4) Combine all parts into final

   userID = lastName + firstName + sUserNum ;

d. Design the logic of your program using pseudocode or flowcharts. Here is where you would use conditionals, loops or functions (if applicable) and list the steps in transforming inputs into outputs. Walk through your logic steps with the test data from the assignment document or the sample run above.

```
DECLARE string firstName
DECLARE string lastName
DECLARE integer userNum
DECLARE string userID

DISPLAY “What is your first name, last name, and an integer (separate each with a space)?"
INPUT firstName, lastName, userNum

SET lastName as the first 5 letters of lastName using substring operations
IF lastName.size is less than 5 THEN
    SET lastName as size of lastName
END IF

SET firstName as the first  letter of firstName using substring operations

SET userNum = userNum % 100;
DELCARE & SET sUserNum as the string version of userNum

SET userID = lastName + firstName + sUserNum ;

DISPLAY “Your username is:”
DISPLAY userID
```

5. Pseudocode Syntax

Think about each step in your algorithm as an action and use the verbs below:

To do this:	Use this verb:	Example:
Create a variable	DECLARE	`DECLARE integer num_dogs`
Print to the console window	DISPLAY	`DISPLAY “Hello!”`
Read input from the user into a variable	INPUT	`INPUT num_dogs`
Update the contents of a variable	SET	`SET num_dogs = num_dogs + 1`
Conditionals		

Use a single alternative conditional	IF *condition* THEN
	    statement
	    statement
	END IF
		`IF num_dogs > 10 THEN`
		`    DISPLAY “That is a lot of dogs!”`
		`END IF`

Use a dual alternative conditional	IF *condition* THEN
	    statement
	    statement
	ELSE
	    statement
	    statement
	END IF
		`IF num_dogs > 10 THEN`
		`    DISPLAY “You have more than 10 dogs!”`
		`ELSE`
		`    DISPLAY “You have ten or fewer dogs!”`
		`END IF`

Use a switch/case statement	SELECT *variable or expression*
	  CASE *value_1:*
	    statement
	    statement
	  CASE *value_2:*
	    statement
	    statement
	  CASE *value_2:*
	    statement
	    statement
	  DEFAULT:
	    statement
	    statement
	END SELECT
		`SELECT num_dogs`
		`   CASE 0: DISPLAY “No dogs!”`
		`   CASE 1: DISPLAY “One dog..”`
		`   CASE 2: DISPLAY “Two dogs..”`
		`   CASE 3: DISPLAY “Three dogs..”`
		`   DEFAULT: DISPLAY “Lots of dogs!”`
		`END SELECT`

Loops		

Loop while a condition is true - the loop body will execute 0 or more times.	WHILE *condition*
	  statement
	  statement
	END WHILE
		`SET num_dogs = 1`
		`WHILE num_dogs < 10`
		`   DISPLAY num_dogs, “ dogs!”`
		`   SET num_dogs = num_dogs + 1`

		END WHILE

Loop while a condition is true - the loop body will execute 1 or more times.	DO
	   statement
	   statement
	WHILE *condition*
		SET num_dogs = 1
		DO
		   DISPLAY num_dogs, “ dogs!”
		   SET num_dogs = num_dogs + 1
		WHILE num_dogs < 10

Loop a specific number of times.	FOR *counter* = *start* TO *end*
	   statement
	   statement
	END FOR
		FOR count = 1 TO 10
		   DISPLAY num_dogs, “ dogs!”
		END FOR

Functions		

Create a function	FUNCTION *return_type name (parameters)*
	   statement
	   statement
	END FUNCTION
		FUNCTION Integer add(Integer num1, Integer num2)
		   DECLARE Integer sum
		   SET sum = num1 + num2
		   RETURN sum
		END FUNCTION

Call a function	CALL *function_name*	CALL add(2, 3)
Return data from a function	RETURN *value*	RETURN 2 + 3