CS 161B: Programming and Problem Solving I

Assignment a02 Algorithm Design Document

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Make a copy before you begin (File -> Make a copy). Add the Assignment # above and complete the sections below BEFORE you begin to code. 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:

- ☑ ~~Paste a screenshot of your zyBooks Challenge and Participation %~~
- ☑ ~~Paste a screenshot of your assigned zyLabs completion~~
- ☑ ~~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~~

1. zyBooks

Add your zyBooks screenshots for the % and assigned zyLabs completions below. Required percentages: all **assigned** zyLabs, Challenge Activity with at least 70%, and Participation Activity with at least 80%.

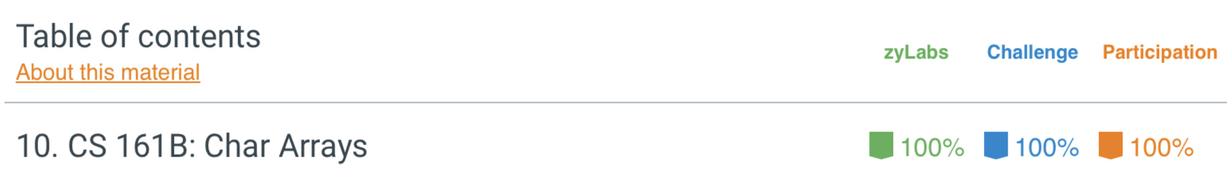
Challenge and Participation % screenshot:


Table of contents
About this material

	zyLabs	Challenge	Participation
10. CS 161B: Char Arrays	🟩 100%	🟦 100%	🟧 100%

Assigned zyLabs completion screenshot:

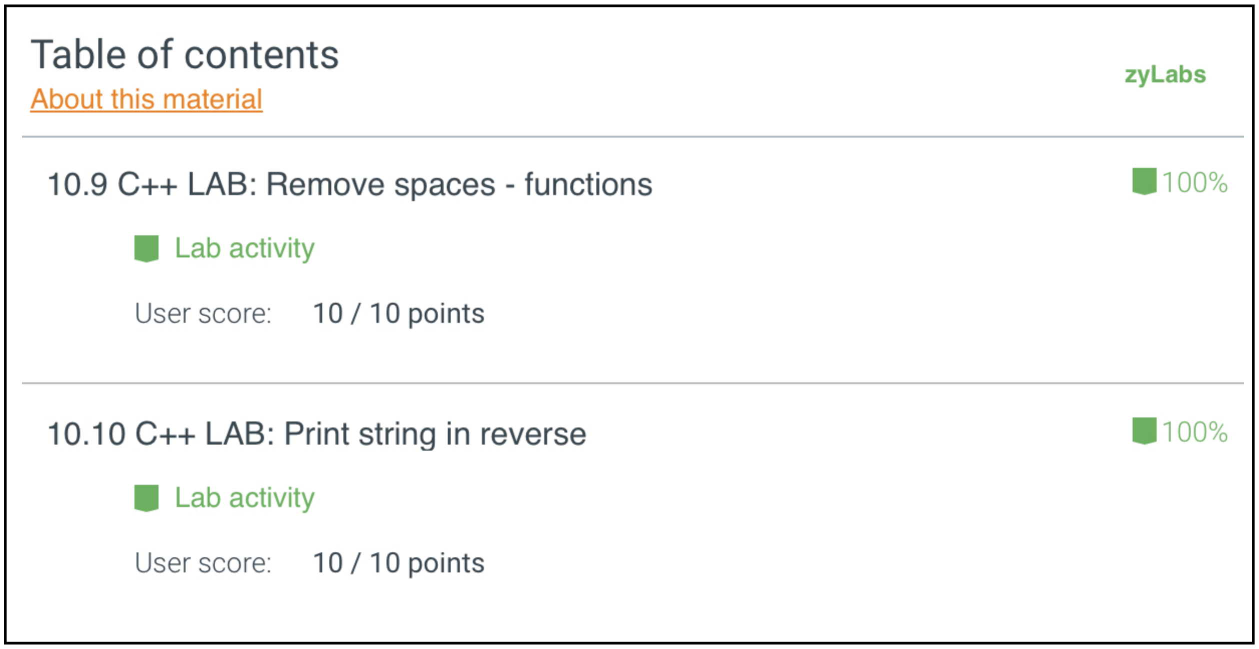


Table of contents
About this material

zyLabs

10.9 C++ LAB: Remove spaces - functions 🟩100%

🟩 Lab activity

User score: 10 / 10 points

10.10 C++ LAB: Print string in reverse 🟩100%

🟩 Lab activity

User score: 10 / 10 points

2. 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 creates an appropriate filename based upon input taken from the user. To do so, it demonstrates use of string functions from the cstring library, character arrays, overloaded functions, and functions with value and reference parameters.

3. 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 program. Calculate and show the expected outputs. Use the sample run to test your program.

Sample run:
Welcome to my fileName encoding program!!

```
Please pick an option below:

(e)Encode a file name

(q)quit

>>e

This program will ask you a few questions and generate an encoded fileName based on your
answers.

Enter your last name: Iyer

Enter your first name: GD

Was your assignment Late (y/n)? Y

Enter your Student-ID (format: 222-22-2222): 234-05-4556

Enter the file name: a05.cpp

Enter the time submitted (military time - ex: 18:24 for 6:24pm): 13:45

Your encoded file name is: iyer_gd_LATE_4556_1345_a05.cpp


Please pick an option below:

(e)Encode a file name

(q)quit

>>b

Invalid option! Please try again!!

Please pick an option below:

(e)Encode a file name

(q)quit

>>q

Thank you for using my fileName generator!
```

4. 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.

Use the pseudocode syntax shown in the document, supplemented with English phrases if necessary. **Do not include any implementation details (e.g. source code file names, class or struct definitions, or language syntax)**. Do not include any C++ specific syntax or data types.

Algorithmic design:

a. Identify and list all of the user input and their data types. Include a variable name, data type, and description. Data types include string, integer, floating point, (single) character, and boolean. Data structures should be referenced by name, e.g. “array of integer” or “array of string (for CS161B and up).

- menuChoice as character
- studentName as array of characters
- lateFlag as array of characters
- studentID as array of characters
- fileName as array of characters
- inputTime as array of characters

b. Identify and list all of the user output and their data types. Include a variable name, data type, and description. Data types include string, integer, floating point, (single) character, and boolean. Data structures should be referenced by name, e.g. “array of integer” or “array of string” (for CS161B and up).

- encodeFileName as array of characters

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. Formulae should reference the variable names from step a and step b as applicable.

```
● DO
    ○ DISPLAY Please pick an option below:
    ○ DISPLAY (e)Encode a file name
    ○ DISPLAY (q)quit
    ○ INPUT into menuChoice
```

```
        ○ IF menuChoice != ‘q’ AND menuChoice != ‘e’ THEN
            ■ DISPLAY Invalid input message
        ○ END IF
    ● WHILE menuChoice != ‘q’ AND menuChoice != ‘e’
```

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.
Use the syntax shown at the bottom of this document and plain English phrases. Do not include any implementation details (e.g. file names) or C++ specific syntax.

```
1. FUNCTION integer main()
    a. DECLARE array of characters encodeFileName
    b. CALL welcome()
    c. CALL displayMenu()

   END FUNCTION main()

2. FUNCTION void welcome()
    a. DISPLAY Welcome to my fileName encoding program!!

   END FUNCTION welcome()

3. FUNCTION character displayMenu()
    a. DECLARE character menuChoice
    b. DO
        i.   DISPLAY Please pick an option below:
        ii.  DISPLAY (e)Encode a file name
        iii. DISPLAY (q)quit
        iv.  INPUT into menuChoice
        v.   IF menuChoice != ‘q’ AND menuChoice != ‘e’ THEN
                 1. DISPLAY Invalid input message
        vi.  END IF
    c. WHILE menuChoice != ‘q’ AND menuChoice != ‘e’
    d. RETURN menuChoice

   END FUNCTION displayMenu()

4. FUNCTION void encode(char encodeFileName[])
    a. DECLARE array of characters fName
    b. DECLARE array of characters lName
    c. DECLARE boolean lateFlag
    d. DECLARE array of characters parsedID
    e. DECLARE array of characters fileName
    f. DECLARE array of characters strTime
    g. CALL readInput(fName, lname, lateFlag)
```

```
        h. CALL readInput(parsedID, fileName)
        i. CALL readTime(char strTime)
        j. SET encodeFileName = lName + “_” + fName + “_” + lateFlag + “_” + parsedID
           + “_” + strTime + “_” + fileName

    END FUNCTION encode()

5.  FUNCTION void readInput(char fName[], char lname[], bool &lateFlag)
        a. DISPLAY Enter your last name:
        b. INPUT into lName
        c. DISPLAY Enter your first name:
        d. INPUT into fName
        e. DISPLAY Was your assignment Late (y/n)?
        f. INPUT into lateFlag

    END FUNCTION readInput()

6.  FUNCTION void readInput(char parsedID[], char fileName[])
        a. DISPLAY Enter your Student-ID (format: 222-22-2222):
        b. INPUT into parsedID
        c. DISPLAY Enter the file name:
        d. INPUT into fileName

    END FUNCTION readInput()

7.  FUNCTION void readTime(char strTime[])
        a. DISPLAY Enter the time submitted (military time - ex: 18:24 for 6:24pm):
        b. INPUT into strTime

    END FUNCTION readTime()
```

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	SET	`SET num_dogs = num_dogs + 1`

variable		
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`