

CS 161A: Programming and Problem Solving I

Assignment A04 Sample Algorithmic Design Document

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:

4. CS 161A: Conditionals Part I

■ 100% ■ 100% ■ 100% ^

Assigned zyLabs completion screenshot:

4.14 LAB: Remove gray from RGB	100%	▼
4.15 LAB: Smallest number	100%	▼

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 Ferry Toll Calculator will show the total cost to a customer who wants to travel to the San Juan islands via Ferry. There are different prices for kids, seniors, adults, and vehicles. A bicycle fee is waived if you are bringing a vehicle already, but otherwise it will add a fee to the cost without a vehicle on board. Additionally, you cannot book more than 20 people + 1 driver at a time. There is also a calculation for if you hit the totalCost near \$100 as you get 1 free adult ticket. The program will tell you how far from the \$100 you are, or show the 1 free ticket messaging. The program ends after any fail statements as per request of the assignment. All invalid characters should be accounted for in the fail/else statements.

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 Gina's Ferry Schedule and Toll Calculator to the beautiful San Juan Islands!
```

Fare Description	Ticket \$
-----	-----
Vehicle Under 14' (less than 168 in) & Driver	\$57.90
Adult (age 19-64)	\$14.95
Senior (age 65 & over) /Disability	\$7.40
Youth (age 6 - 18)	\$5.55
Bicycle Surcharge(included with Vehicle)	\$4.00

```
Are you riding the ferry with a vehicle? (Y/N):
```

```
y
```

```
How many adults?
```

2
How many seniors?
1
How many youths?
0

You are welcome to bring a bicycle on your journey with your vehicle if your party is under 20 + driver. :)
Your total cost is: \$95.20
You are \$4.80 away from earning a free adult ticket for your next trip.

Welcome to Gina's Ferry Toll Calculator to the beautiful San Juan Islands!
Fare Description Ticket \$

Vehicle Under 14' (less than 168 in) & Driver \$57.90
Adult (age 19-64) \$14.95
Senior (age 65 & over) /Disability \$7.40
Youth (age 6 - 18) \$5.55
Bicycle Surcharge(included with Vehicle) \$4.00
Are you riding the ferry with a vehicle? (Y/N):
n
You chose no! You are NOT bringing a vehicle onto the ferry.
How many adults?
2
How many seniors?
1
How many youths?
1
How many bicycles?
2
Your total cost is: \$50.85
You are \$49.15 away from earning a free adult ticket for your next trip.

Welcome to Gina's Ferry Toll Calculator to the beautiful San Juan Islands!
Fare Description Ticket \$

Vehicle Under 14' (less than 168 in) & Driver \$57.90
Adult (age 19-64) \$14.95
Senior (age 65 & over) /Disability \$7.40
Youth (age 6 - 18) \$5.55
Bicycle Surcharge(included with Vehicle) \$4.00
Are you riding the ferry with a vehicle? (Y/N):
n
You chose no! You are NOT bringing a vehicle onto the ferry.
How many adults?
-7
Invalid number of adults. The program will now restart. If you need to book 20 people + driver, please give us a call.

Welcome to Gina's Ferry Toll Calculator to the beautiful San Juan Islands!
Fare Description Ticket \$

Vehicle Under 14' (less than 168 in) & Driver \$57.90
Adult (age 19-64) \$14.95
Senior (age 65 & over) /Disability \$7.40
Youth (age 6 - 18) \$5.55
Bicycle Surcharge(included with Vehicle) \$4.00
Are you riding the ferry with a vehicle? (Y/N):
n
You chose no! You are NOT bringing a vehicle onto the ferry.
How many adults?
12

```

How many seniors?
4
How many youths?
5
How many bicycles?
2
Error! There are too many people in your group. Please split up your groups into
chunks of 21 people. The program will now restart.

```

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.

Algorithmic design:

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

- **vehicleResponse** (char) → when answering “y” or “n”
- **adultsOnTrip** (integer)
- **seniorsOnTrip** (integer)
- **youthsOnTrip** (integer)
- **bicyclesOnTrip** (integer)

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

- *welcome message* (string literal)
- **vehicleFare** (double)
- **adultFare** (double)
- **seniorFare** (double)
- **youthFare** (double)
- **bicycleFare** (double)
- **totalPeople** (integer)
- **totalCost** (double)
- **invalidAdult** (string literal)
- **invalidSenior** (string literal)
- **invalidYouth** (string literal)
- **invalidBicycles** (string literal)
- **invalidVehicle** (string literal)
- **difference** (double) ← used near the end
- *exit message* (string literal)

- 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.

- before main(), I did create an error/end program function (boolean)
 1. These are when the if else statements fail
- `totalCost += vehicleFare` ← my thoughts were to calculate as I go
- `totalCost += (bicyclesOnTrip * bicycleFare);` ← “
- `totalPeople = adultsOnTrip + seniorsOnTrip + youthsOnTrip + 1` (1 is the driver)
- `totalCost += (adultsOnTrip * adultFare) + (seniorsOnTrip * seniorFare) + (youthsOnTrip * youthFare);`

- 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.

The flowchart is very long and tall, so I will attach it as a separate attachment. I wanted to try the flowchart instead of the pseudocode this time.

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 <i>condition</i> THEN <i>statement</i> <i>statement</i> END IF	IF num_dogs > 10 THEN DISPLAY "That is a lot of dogs!" END IF

Use a dual alternative conditional	<pre>IF <i>condition</i> THEN <i>statement</i> <i>statement</i> ELSE <i>statement</i> <i>statement</i> END IF</pre>	<pre>IF num_dogs > 10 THEN DISPLAY "You have more than 10 dogs!" ELSE DISPLAY "You have ten or fewer dogs!" END IF</pre>
Use a switch/case statement	<pre>SELECT <i>variable or expression</i> CASE <i>value_1</i>: <i>statement</i> <i>statement</i> CASE <i>value_2</i>: <i>statement</i> <i>statement</i> CASE <i>value_2</i>: <i>statement</i> <i>statement</i> DEFAULT: <i>statement</i> <i>statement</i> END SELECT</pre>	<pre>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</pre>
Loops		
Loop while a condition is true - the loop body will execute 0 or more times.	<pre>WHILE <i>condition</i> <i>statement</i> <i>statement</i> END WHILE</pre>	<pre>SET num_dogs = 1 WHILE num_dogs < 10 DISPLAY num_dogs, " dogs!" SET num_dogs = num_dogs + 1 END WHILE</pre>
Loop while a condition is true - the loop body will execute 1 or more times.	<pre>DO <i>statement</i> <i>statement</i> WHILE <i>condition</i></pre>	<pre>SET num_dogs = 1 DO DISPLAY num_dogs, " dogs!" SET num_dogs = num_dogs + 1 WHILE num_dogs < 10</pre>
Loop a specific number of times.	<pre>FOR <i>counter</i> = <i>start</i> TO <i>end</i> <i>statement</i> <i>statement</i> END FOR</pre>	<pre>FOR count = 1 TO 10 DISPLAY num_dogs, " dogs!" END FOR</pre>
Functions		
Create a function	<pre>FUNCTION <i>return_type</i> <i>name (parameters)</i> <i>statement</i> <i>statement</i> END FUNCTION</pre>	<pre>FUNCTION Integer add(Integer num1, Integer num2) DECLARE Integer sum SET sum = num1 + num2 RETURN sum END FUNCTION</pre>
Call a function	CALL <i>function_name</i>	CALL add(2, 3)

Return data from a function	RETURN <i>value</i>	RETURN 2 + 3
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