CS 161A: Programming and Problem Solving I

# Assignment A02 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.ne](https://www.draw.io/)t

## 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%.

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| **Challenge and Participation % screenshot:** |
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| **Assigned zyLabs completion screenshot:** |
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## 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.

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| **Program description:** |
| This program will calculate your week’s paystub and outline that various withholding from it. Entering in your employee number, hours worked this week, and your hourly wage, you will see a detailed summary of your paystub. |

## 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.

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| **Sample run:** |
| Welcome to my Weekly Payroll program!!  Enter your employee ID number (numbers only): **17018**  Enter number of hours worked (whole numbers): **64**  Enter the hourly rate: **38.626426154721613437**  Enter the federal withholding rate: **15.9476916432761**  Your Payroll Summary:  Total Gross Pay: $2472.09  FICA deductions: $189.11  Federal Tax Withholding: $394.24  Total deductions: $583.36  Net Pay: $1888.73  Thank you for using my Weekly Payroll program!! |
| Welcome to my Weekly Payroll program!!  Enter your employee ID number (numbers only): **17018**  Enter number of hours worked (whole numbers): **40**  Enter the hourly rate: **39.99**  Enter the federal withholding rate: **14.95**  Your Payroll Summary:  Total Gross Pay: $1599.60  FICA deductions: $122.37  Federal Tax Withholding: $239.14  Total deductions: $361.51  Net Pay: $1238.09  Thank you for using my Weekly Payroll program!! |

## 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.

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| **Algorithmic design:** |
| 1. Identify and list all of the user input and their data types. |
| Int empID  Int numHours  Double wageHour  Double rateWithold |
| 1. Identify and list all of the user output and their data types. |
| Double payGross  Double deductionFICA  Double deductionFederal  Double deductionTotal  Double payNet |
| 1. 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. |
| payGross = numHours \* wageHour  deductionFICA = payGross \* (FICADEDUCT / 100)  deductionFederal = payGross \* (rateWithold / 100)  deductionTotal = deductionFICA + deductionFederal  payNet = payGross - deductionTotal |
| 1. 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. |
| START  DECLARE Int empID  DECLARE Int numHours  DECLARE Double wageHours  DECLARE Double rateWithold  DECLARE Double payGross  DECLARE Double payNet  DECLARE Double deductionFICA  DECLARE Double deductionFederal  DECLARE Double deductionTotal  DECLARE Const Double FICADEDUCT = 7.65  SET setprecision (2), fixed  DISPLAY "Welcome to my Weekly Payroll program!!"  DISPLAY "Enter your employee ID number (numbers only): "  INPUT empID  DISPLAY "Enter number of hours worked (whole numbers): "  INPUT numHours  DISPLAY "Enter the hourly rate: "  INPUT wageHour  DISPALY "Enter the federal withholding rate: "  INPUT rateWithold  SET payGross = numHours \* wageHour  SET deductionFICA = payGross \* (FICADEDUCT / 100)  SET deductionFederal = payGross \* (rateWithold / 100)  SET deductionTotal = deductionFICA + deductionFederal  SET payNet = payGross - deductionTotal  DISPLAY "Your Payroll Summary:"  DISPLAY "Total Gross Pay: $" + payGross  DISPLAY "FICA deductions: $" + deductionFICA  DISPLAY "Federal Tax Withholding: $" + deductionFederal  DISPLAY "Total deductions: $" + deductionTotal  DISPLAY "Net Pay: $" + payNet  DISPLAY "Thank you for using my Weekly Payroll program!!"  END |

## 5. Pseudocode Syntax

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

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| **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 = star*t 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 |