**1st SIT COURSEWORK:** **Spring Semester 2020**

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| **Module Code:** | **CS4051NA** |
| **Module Title:** | **Fundamentals of Computing** |
| **Module Leader:** | **Sukrit Shakya** (Islington College) |

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| **Coursework Type:** | **Individual** |
| **Coursework Weight:** | This coursework accounts for **60%** of your total module grades. |
| **Submission Date:** | **Week 12, Friday, 8th May, 2020** |
| **When Coursework is given out:** | **Week 8** |
| **Submission Instructions:** | Submit the following to Islington College RTE department before the due date:<br>• **Soft copy of the report**<br>• **Zip file with source code of the program** |
| **Warning:** | London Metropolitan University and Islington College takes Plagiarism seriously. Offenders will be dealt with sternly. |

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## Plagiarism Notice

You are reminded that there exist regulations concerning plagiarism.

### Extracts from University Regulations on Cheating, Plagiarism and Collusion

Section 2.3: “The following broad types of offence can be identified and are provided as indicative examples

(i) Cheating: including copying coursework.
(ii) Falsifying data in experimental results.
(iii) Personation, where a substitute takes an examination or test on behalf of the candidate. Both candidate and substitute may be guilty of an offence under these Regulations.
(iv) Bribery or attempted bribery of a person thought to have some influence on the candidate’s assessment.
(v) Collusion to present joint work as the work solely of one individual.
(vi) Plagiarism, where the work or ideas of another are presented as the candidate’s own.
(vii) Other conduct calculated to secure an advantage on assessment.
(viii) Assisting in any of the above.

### Some notes on what this means for students:

(i) Copying another student's work is an offence, whether from a copy on paper or from a computer file, and in whatever form the intellectual property being copied takes, including text, mathematical notation and computer programs.
(ii) Taking extracts from published sources without attribution is an offence. To quote ideas, sometimes using extracts, is generally to be encouraged. Quoting ideas is achieved by stating an author's argument and attributing it, perhaps by quoting, immediately in the text, his or her name and year of publication, e.g. " e = mc2 (Einstein 1905)". A reference section at the end of your work should then list all such references in alphabetical order of authors' surnames. (There are variations on this referencing system which your tutors may prefer you to use.) If you wish to quote a paragraph or so from published work then indent the quotation on both left and right margins, using an italic font where practicable, and introduce the quotation with an attribution.

Further information in relation to the existing London Metropolitan University regulations concerning plagiarism can be obtained from http://www.londonmet.ac.uk/academic-regulations

## Summary

This is an individual coursework worth 60% of the total module mark. It requires developing a software application which simulates the behavior of a digital circuit performing integer addition and writing a report to describe the model, algorithm, data structures needed as well as the program developed.

## Tasks

a) Construct a model of a byte adder assembled using electronic gates based on the model of the bit adder (represented by the picture below).

b) Specify an algorithm for integer addition based on bitwise operations.

c) Select suitable Python data structures to represent the information to be processed by the program.

d) Create a program in Python which implements the model of the adder as designed in the previous task.

e) Test the program with selected test data.

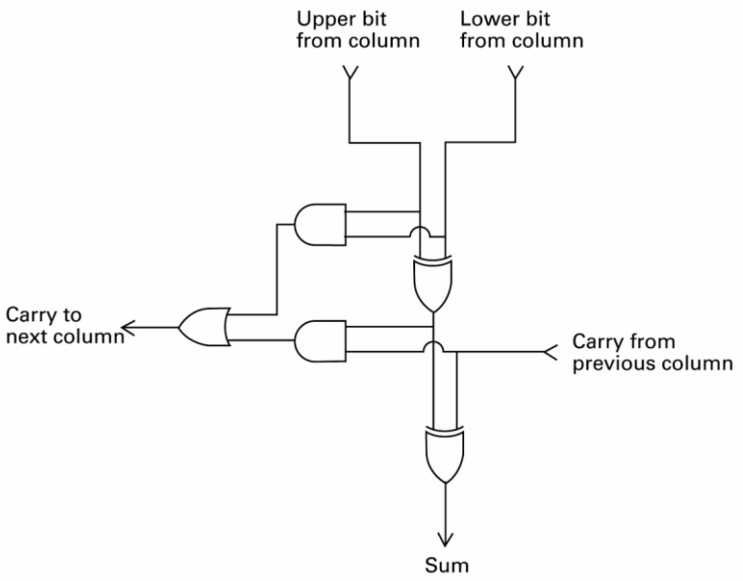
f) Write a report to present the work above.

The detail of each task is illustrated below.

## Requirements

### 1. Model

- The model must be based on the bit adder



- The model may include number of bit adders linked to form a **byte** adder.

- The model can be presented using suitable diagram/picture created using drawing tool or graphics editor of your choice (the bit adder can be a box with input and output only).

## 2. Algorithm

- The algorithm for adding two integers must be based on the use of standard logical operations which have direct hardware implementation (AND, OR, XOR, NOT)

- It can use additional data processing operations which might be necessary to manipulate the data (i.e., input/output operations, type conversion operations, information retrieval operations, etc.)

- The algorithm must be specified using pseudocode.

- The algorithm must be illustrated using a diagram (flowchart).

## 3. Data Structures

- The programming should be done using data structures and operations in Python for input/output, character and string processing, logical manipulations.

- It can use any primitive or complex data structures which might be necessary for holding the data (lists, tuples, strings, dictionaries, etc.)

- The choice of data structures must be specified in the report.

## 4. Program

- The program must work in a loop, reading two integer numbers, computing the sum of them and printing out the result until instructed to quit.

- The program must check the input data for the data type permitted (representation of an integer) and the data value limitations (the value of the integer must not exceed the actual size of byte-coded integers, i.e. min 00000000 and max 11111111 in Base 2 or min 0 and max 255 in Base 10).

- The program must be implemented in a modular way with separate functions for inputting data, bit operations, integer operations and outputting the result of the calculation.

## 5. Testing

- The tests must be performed after completing the development in order to gather suitable data for reporting. (at least 5 test cases must be present)

- The test data used for testing the programs must include normal data, special values (if any), max/min values, wrong data types, wrong values.

- The tests must be described in terms of testing cases (or scenarios), input data, expected results, actual results and analysis of the results. They can be presented in a table form reporting each case separately and can be illustrated using screen shots of the execution.

## 6. Report

- The report must present all components of the work – model, algorithm, data structures, program and testing.

- The program must be described in terms of its structure and behaviour. It can be presented using text and structural charts, flowcharts or other diagrams as needed.

- The report must have a title page, table of contents, page numbers, list of figures and tables, footer.

- The report must have an ***Introduction*** section introducing the different aspects of the project. The goals and objectives of the project should be included as well.

- The report must also include a ***Conclusion*** section where they need to reflect on the work done.

**NOTE:** The technicality of the project will be judged during the demo and marked accordingly. If any individual student is not able to justify his/her project, then the project will be kept under plagiarism.

## Marking Scheme

| University Grading Scheme for Undergraduate Programs: 2019/20 | | |
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| Marking criteria | Letter grade | Mark recorded |
| **C1 – Work Showing Evidence:**<br>1. *Introduction section has been properly written, describes the subject matter well and a high level of understanding of the topics has been shown.*<br>2. *The adder model is well explained with proper diagrams. A high level of understanding of the topic is seen.*<br>3. *The program's algorithm has been properly described in a stepwise manner as well as in terms of a clear properly presented flowchart; pseudocode has been presented in a proper and clear manner as well.*<br>4. *Python data types/data structures have been properly explained with suitable examples and a high level of understanding has been displayed.*<br>5. *The program works flawlessly, performs the required operations. The program does not crash when undesired input is given by the user (proper exception handling has been done). Code is properly structured and follows good programming practices. Classes/Functions have been well implemented and the program has been properly structured in a modular manner.*<br>6. *The program has been well tested with at least 5 proper test cases, and presented with proper testing format.*<br>7. *A well written conclusion has been given and the report is well-structured, written in good English, free from spelling and grammatical errors and is written in a professional style of a technical article and presented at a high standard.*<br>8. *The student's performance in the VIVA was perfect in every respect.* | A+ | 95 |
| **C2 – Work Showing Evidence:**<br>1. *Introduction section has been properly written and proper understanding of the topics has been shown.*<br>2. *The adder model is well explained with proper diagrams. A proper level of understanding of the topic is seen.*<br>3. *The program's algorithm has been properly described in a stepwise manner as well as in terms of a clear well-presented flowchart; pseudocode has been presented in a proper and clear manner as well.*<br>4. *Python data types/data structures have been properly explained with suitable examples and a high level of understanding has been displayed.*<br>5. *The program works flawlessly, performs the required operations. The program does not crash when undesired input is given by the user (proper exception handling has been done). Code is properly structured and follows* | A | 85 |

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| *good programming practices.*<br>6. *The program has been well tested with at least 5 proper test cases, and presented with proper testing format.*<br>7. *The report is well structured, written well, and free from spelling and grammatical errors and is written at a very good quality standard. Good conclusion has been given at the end.*<br>8. *The student showed a level of understanding and insight very much beyond what is expected at this level.* | | |
| **C3 – Work Showing Evidence:**<br>1. *Introduction section has been properly written and good understanding of the topics has been shown.*<br>2. *The adder model is well explained with proper diagrams. A good level of understanding of the topic is seen.*<br>3. *The program's algorithm has been properly described in a stepwise manner as well as in terms of a clear flowchart; pseudocode has been presented in a proper manner.*<br>4. *Python data types/data structures have been properly explained with suitable examples and a good level of understanding has been displayed.*<br>5. *The program works flawlessly, performs the required operations. The program does not crash when undesired input is given by the user (proper exception handling has been done). Code is properly structured and follows good programming practices.*<br>6. *The program has been well tested with at least 5 proper test cases, and presented with proper testing format.*<br>7. *The report is well structured, written well, and free from spelling and grammatical errors and is written at a good quality standard. Good conclusion has been given at the end.*<br>8. *The student showed a level of understanding and insight beyond what is expected at this level.* | A- | 75 |
| **C4 – Work Showing Evidence:**<br>1. *Introduction section has been properly written and fair understanding of the topics has been shown.*<br>2. *The adder model is explained fairly well with proper diagrams. A fair level of understanding of the topic is seen.*<br>3. *The program's algorithm has been properly described in a stepwise manner as well as in terms of a flowchart; pseudocode has been presented in a proper manner.*<br>4. *Python data types/data structures have been properly explained with suitable examples and a reasonable level of understanding has been displayed.*<br>5. *The program works well, and performs the required operations. The program does not crash when undesired input is given by the user (proper exception handling has been done).* | B+ | 67 |

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| *6. The program has been well tested with at least 5 proper test cases and presented well.*<br>*7. The report is a structured one, written reasonably well but may contain only minor typos and grammatical errors but on the whole is good report. Good conclusion has been given at the end.*<br>*8. The student displayed a better than average level of understanding.  The student was able to answer most questions clearly and with insight.* | | |
| **C5 – Work Showing Evidence:**<br>*1. Introduction section has been written well and reasonable understanding of the topics has been shown.*<br>*2. The adder model is explained fairly well with proper diagrams. A reasonable level of understanding of the topic is seen.*<br>*3. The program's algorithm has been properly described in a stepwise manner as well as in terms of a flowchart; pseudocode has been presented in an understandable manner.*<br>*4. Python data types/data structures have been properly explained with suitable examples and a reasonable level of understanding has been displayed.*<br>*5. The program works well, and performs the required operations. After each transaction the program writes a note to a file giving it a unique filename. Minimum requirements have been met.*<br>*6. The program has been well tested with at least 5 proper test cases.*<br>*7. The report is written well but may contain some spelling and grammatical mistakes but on the whole is a reasonable report.*<br>*8. The student displayed a level of understanding which is about what would be expected.* | B | 63 |
| **C6 – Work Showing Evidence:**<br>*1. Introduction section has been written well and reasonably explained.*<br>*2. The adder model is explained reasonably. A satisfactory level of understanding of the topic is seen.*<br>*3. The program's algorithm has been properly described in a stepwise manner as well as in terms of a flowchart; pseudocode has been presented in a satisfactory manner.*<br>*4. Python data types/data structures have been properly explained and a satisfactory level of understanding has been displayed.*<br>*5. The program works but minor errors and shortcomings are present. Minimum requirements have been met.*<br>*6. The program has been well tested with at least 5 proper test cases.*<br>*7. The report is written with a satisfactory standard but* | C+ | 57 |

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| *may contain spelling and grammatical errors.*<br>8. *The student displayed a level of understanding which is considered to be the minimum acceptable at this level. The student was able to answer some questions.* | | |
| **C7 – Work Showing Evidence:**<br>1. *Introduction section had been written well and reasonably explained.*<br>2. *The adder model is reasonably explained. A satisfactory level of understanding of the topic is seen.*<br>3. *The program's algorithm has been described in a stepwise manner as well as in terms of a flowchart; pseudocode has been presented in a satisfactory manner.*<br>4. *Python data types/data structures have been properly explained and a satisfactory level of understanding has been displayed.*<br>5. *In the program minimum requirements have been met and the program contains minor errors.*<br>6. *The program has been well tested with at least 5 proper test cases.*<br>7. *The report is written at a satisfactory level but contains spelling and grammatical errors.*<br>8. *The student displayed a level of understanding which is considered to be the minimum acceptable at this level. The student was able to answer some questions.* | C | 53 |
| **C8 – Work Showing Evidence:**<br>1. *Introduction section has been written in an acceptable manner.*<br>2. *The adder model is satisfactorily explained. A satisfactory level of understanding of the topic is seen.*<br>3. *The program's algorithm has been described in a stepwise manner as well as in terms of a flowchart; pseudocode has been presented in a satisfactory manner.*<br>4. *Python data types/data structures have been properly explained and a basic level of understanding has been displayed.*<br>5. *In the program minimum requirements have been met and the program contains errors.*<br>6. *The program has been well tested with at least 5 proper test cases.*<br>7. *The report is written at a satisfactory level, which may lack structure and/or contain spelling and grammatical errors.*<br>8. *The student showed a little understanding and was only able to answer the most basic questions.* | D+ | 47 |
| **C9 – Work Showing Evidence:**<br>1. *Introduction section has been written in an acceptable manner. Proper explanations are lacking.* | D | 43 |

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| *2. The adder model is just satisfactorily explained.*<br>*3. The program's algorithm has been described in a stepwise manner as well as in terms of a flowchart; pseudocode has been presented in a satisfactory manner.*<br>*4. Python data types/data structures have been satisfactorily explained and only a basic level of understanding has been displayed.*<br>*5. In the program minimum requirements have been met and the program contains errors.*<br>*6. The program has been well tested with at least 5 proper test cases.*<br>*7. The report lacks structure and/or contains spelling and grammatical errors but on the whole just reaches an acceptable level.*<br>*8. The student showed a little understanding and was only able to answer the most basic questions.* | | |
| **C10 – Work Showing Evidence:**<br>*1. Introduction section has been poorly written. Proper explanations are lacking.*<br>*2. The adder model is poorly explained.*<br>*3. The program's algorithm has been described in a stepwise manner as well as in terms of a flowchart; pseudocode has been presented in a poor manner. Explanations are not clear.*<br>*4. Python data types/data structures have been poorly explained and a poor level of understanding has been displayed.*<br>*5. The program does not work well. The program contains errors.*<br>*6. The program has not been properly tested.*<br>*7. The report lacks structure presented poorly and contains spelling and grammatical errors, which on the whole is not at an unacceptable standard.*<br>*8. The student showed almost no understanding of the technical content of the project and was unable to answer even the most basic questions.* | F1 | 37 |
| **C11 – Work Showing Evidence:**<br>*1. Introduction section has been poorly written. Proper explanations are lacking.*<br>*2. The adder model is poorly explained/lacking.*<br>*3. The program's algorithm and flowchart are not clear. Pseudocode is poorly written. Explanations are not clear.*<br>*4. Python data types/data structures have been poorly explained and a poor level of understanding has been displayed.*<br>*5. The program does not work well. The program contains errors.*<br>*6. The program has not been properly tested.*<br>*7. The report is very poorly presented with no level of* | F2 | 23 |

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| *structure and cohesion, which contains spelling, and grammatical errors that make it considerably lower than just an acceptable technical report expected at this level.*<br>*8. The student showed almost no understanding of the technical content of the project and was unable to answer even the most basic questions.* |  |  |
| Fail (non-submission or submission of work which cannot be given any credit (e.g., blank submission, incorrect assignment) | F3 | 0 |