UWS UNIVERSITY OF THE WEST *of* SCOTLAND

INTRODUCTION TO PROGRAMMING (COMP07027)

COURSEWORK 2017-18

INTRODUCTION

This document describes the coursework for this module. Your final project work is to build a small application in the Python programming language used in the module and to document the process.

The development work for this coursework may be completed in pairs (recommended because it is good to have someone to discuss the problem and solution with, but you may NOT work in groups larger than two) or individually. If you work as a pair this means working on all parts of the program together (the report is an individual report, but the development and testing of the code should be done jointly) – it is not intended that you delegate different parts of the implementation work to partners individually, though it is acceptable for you to identify who will do the lead work for each function/part (as in, who types the code in to the computer once the algorithm/logic has been agreed and who sits and watches over their shoulder!), and you may wish to decide that where one person takes the lead on implementing some function that the other person takes the lead responsibility for testing it. If you are in a pair then each pair will submit a single project and documentation and *an individual critical appraisal (for each partner)* as described in WHAT TO SUBMIT, below.

PROJECT DESCRIPTION

The Paisley Precision Engineering Company (PPEC) manufactures aircraft components. They make three different types of component (*Winglet Attachment Struts*, *Door Seal Clamp Handles* and *Rudder Pivot Pins*), each of which performs a critical function, must meet the very highest quality standards and must also be fully traceable throughout its intended lifecycle. Each type of component is manufactured in small batches and individually identified by both a manufacturers' batch number and an individual component serial number to ensure traceability. Components are manufactured in two stages. Firstly, each batch is cast and machined to produce complete (but unfinished) components that are kept in the company's warehouses. Whenever a customer orders a component(s) they provide details of the finish they require, for example some customers prefer a polished metal finish while others prefer a painted finish to match their corporate livery. Components are finished and held in the same warehouse pending dispatch to the client.

Rudder Pivot Pins are manufactured in 3 different sizes (*10mm diameter x 75mm length*, *12mm diameter x 100mm length* and *16mm diameter x 150mm length*) and are suitable for fitting to a wide variety of aircraft types. *Door Seal Clamp Handles* are a universal fit for all aircraft and *Winglet Attachment Struts* will only fit a specific type of aircraft. Currently *Winglet Attachment Struts* are manufactured for two aircraft types (*Airbus A320 series* and *Airbus A380 series*). The company operates from two locations. The main location in Paisley consists of foundry, machine shop, warehouse and product finishing facilities. The second location in Dubai consists of a warehouse and a finishing facility. Therefore, although all components are manufactured at Paisley the complete (but unfinished) components may be stored and finished at either location.

You are required to design and implement an inventory system capable of recording and tracking each component from manufacture, through storage to finishing. You should design and implement your system by carefully following the guidance provided in the STEPWISE DEVELOPMENT AND MARKING SCHEME section below.

MINIMUM STANDARD

This coursework component accounts for 80% of your overall mark for the module. In each of steps 1 to 4 outlined below, the indicated marks are awarded for functionality. In order to obtain maximum marks at each step your program must fully implement a working solution to each of the functional components listed under that step.

The specification provided here outlines the minimum functionality required by your program, however you can add extra functionality which, if done well and properly documented, will attract additional marks. (see ADDITIONAL ASSESSED COMPONENTS) Some examples of additional functionality might include a well-designed user interface which includes several different EasyGUI widgets, or introducing features/packages/modules not covered in the lectures. Remember that any code that you find online must be properly referenced both as a comment in your code and in the accompanying documentation.

STEPWISE DEVELOPMENT AND MARKING SCHEME

You are **strongly advised** to develop the program by completing the following 4 steps one step at a time and keeping a copy of working versions of each step. At each step in the development process you should design appropriate tests to ensure that your code works as expected. N.B. the examples shown below assume a CLI implementation, this has been done to illustrate all the required menu options at each step of the development. You are not obliged to implement a CLI version of the program and although the marks shown for each of the 4 steps below can be achieved using a CLI implementation using a GUI implementation will attract extra marks.

STEP 1 (20 MARKS)

Whenever a new batch of components is manufactured, the component type, size or model, batch number, number of components in the batch, individual serial number and date of manufacture of each individual component in the batch must be recorded. You are required to create (as a minimum) two classes named *Batch* and *Component* each with appropriate attributes and methods to implement the functionality outlined below. Your system must include a menu allowing the user to either create a new batch or quit the program. An example run of the program is shown below. (N.B. This example illustrates the minimum functionality required at this step – all input methods and layouts shown are for illustration only, you should choose the most appropriate methods and layouts for your proposed solution).

Your application should automatically generate a unique, sequential number for each new batch made. The batch number should take the form **DDMMYY9999** where DDMMYY is the date of manufacture and 9999 is a unique sequential number between 0001 and 9999. You are required to maintain an index of each batch number that has been used. The index of batch numbers should be stored in a file named *BatchIndex.json*. Your application will need to manage this file with read and write/update operations. You should also provide a unique, sequential serial number for each individual component in the form **DDMMYY9999-9999** where DDMMYY9999 is the batch number and -9999 is the unique sequential component number in the range 0001 to 9999.

When you have completed the coding of this step you should save the completed Python file as Step1.py. You should also create a testing plan for this step (as a section in your overall testing document). The testing plan must be accompanied by an example input data set, details of expected outputs and screen dumps from testing of your application as evidence of successful testing. The testing plan document, python file and BatchIndex.json file used during testing should all be placed in a folder named Step1 following the folder structure shown in WHAT TO SUBMIT

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  Quit

>>> 2

Goodbye
```

```
Welcome to the PPEC inventory system

 Choose an option:

    1.  Create a new batch
    2.  Quit

>>> 1



Create New Batch

Batch Number DDMMYY0001

How many components in this batch (1 to 9999)? > 3

Select component type (1. Winglet Strut, 2. Door Handle, 3. Rudder Pin) > 1

Select Size/fitment type (1. A320 Series, 2. A380 Series) > 2

This batch contains 3 A380 Winglet Struts is this correct Y/N? Y

Batch and component records created at HHMM on DDMMYYYY

Print batch details Y/N? Y

Batch Number: DDMMYY0001

Manufacture Date: DDMMYYYY

Component Type: Winglet Strut

Component size/fitment type: A380

Number of components in batch: 3

Serial Numbers: [DDMMYY0001-0001, DDMMYY0001-0002, DDMMYY0001-0003]

Component status: [

                DDMMYY0001-0001 Manufactured-unfinished,

                DDMMYY0001-0002 Manufactured-unfinished,

                DDMMYY0001-0003 Manufactured-unfinished

                ]

Press any key to return to menu
```

N.B. After the user has selected the component type, the next prompt should provide appropriate choices for size/fitment type according to the descriptions of each component type provided in the PROJECT DESCRIPTION above. If the user answers No to the question *"This batch contains….is this correct?"*, the user should be allowed to re-enter all of the information for the current batch. If the user chooses not to print details of a batch the *"Press any key to return to menu"* prompt should immediately be displayed. Your code should include appropriate input validation and error checking routines.

STEP 2 (15 MARKS)

Build on step 1 by creating a copy of Step1.py and renaming it as **Step2.py**.

Extend your code from step 1 such that each individual instance of the batch class is stored in a pickled file with a file name that corresponds to the batch number (e.g. DDMMYY0001.pck) and each individual instance of the component class is stored in a pickled file with a filename that corresponds with the component's serial number (e.g. DDMMYY0001_0001.pck). File creation should happen automatically after the user has answered yes to the *"This batch contains…… is this correct"* question. Your code should contain appropriate functionality to both write each file to disc and to successfully retrieve and display the information contained in the files. The menu should be extended to allow retrieval and display of the full details of previously created batches and components from disc with appropriate batch/component serial number validation to correctly handle invalid user input. You should also include a menu option to display a list of all batches in the system.

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Quit

>>> 5

Goodbye
```

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Quit

>>> 3

Enter batch number: MMDDYY_008

Batch not found press any key to return to menu
```

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Quit

>>> 3

Enter batch number: DDMMYY0001

Batch Number: DDMMYY0001

Manufacture Date: DDMMYYYY

Component Type: Winglet Strut

Component size/fitment type: A380

Number of components in batch: 3

Serial Numbers: [DDMMYY0001-0001, DDMMYY0001-0002, DDMMYY0001-0003]

Component status: [

                DDMMYY0001-0001 Manufactured-unfinished,

                DDMMYY0001-0002 Manufactured-unfinished,

                DDMMYY0001-0003 Manufactured-unfinished

                ]

Press any key to return to menu
```

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Quit

>>> 2

List of all batches recorded in system:

Batch#          Type                Size/Fit        Quantity Made

DDMMYY001       Winglet Strut       A380            3

DDMMYY002       Rudder Pin          12x100          5

End of List

Press any key to return to menu
```

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Quit

>>>  4

Enter Component Serial number: MMDDYY6789_0987

Component not found press any key to return to menu
```

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Quit

>>>  4

Enter Component Serial number: DDMMYY0001-0001

Component Details for DDMMYY0001-0001

Type:               Winglet Strut

Size/Fit:           A380

Date of Manufacture:  DDMMYY

Current Status:     Manufactured-unfinished

Part of Batch:      DDMMYY0001

Press any key to return to menu
```

When you have completed the coding of this step you should save the completed Python file as Step2.py. You should also create a testing plan for this step (as a section in your overall testing document). The testing plan must be accompanied by an example input data set, details of expected outputs and screen dumps from testing of your application as evidence of successful testing. The testing plan document, python file and *BatchIndex.json* file, and copies of the batch and component files used during testing should all be placed in a folder named Step2 following the folder structure shown in WHAT TO SUBMIT

Build on step 2 by creating a copy of Step2.py and renaming it as Step3.py.

Extend your code from step 2 to now include allocation of batches of manufactured-unfinished components to one of the company's warehouse locations. Entire batches of manufactured goods are to be allocated in one step. You will need to further extend the menu to include this option. To facilitate this change your application will now need to keep track of the location of each batch of components. When batches have just been manufactured and are first entered into the system using menu option 1, they should have a location status of "*Factory Floor – Warehouse Not Allocated*". The system should only allow allocation of batches that have this location status (i.e. your system should not permit inter location transfers of stock). The batch list and view batch details menu options should now show where each batch is located.

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Allocate manufactured stock
    6.  Quit

>>> 6

Goodbye
```

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Allocate manufactured stock
    6.  Quit

>>> 5

Enter batch number: MMDDYY_008

Batch not found press any key to return to menu
```

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Allocate manufactured stock
    6.  Quit

>>> 5

Enter batch number: DDMMYY0001

Batch already allocated press any key to return to menu
```

```
Welcome to the PPEC inventory system

Choose an option:

        1.  Create a new batch
        2.  List all batches
        3.  View details of a batch
        4.  View details of a component
        5.  Allocate manufactured stock
        6.  Quit

>>> 5

Enter batch number: DDMMYY0001

Select Warehouse (1. Paisley, 2. Dubai) > 2

This batch is now allocated and will be shipped to the Dubai location

Press any key to return to the menu
```

```
Welcome to the PPEC inventory system

Choose an option:

        1.  Create a new batch
        2.  List all batches
        3.  View details of a batch
        4.  View details of a component
        5.  Allocate manufactured stock
        6.  Quit

>>> 2

List of all batches recorded in system:

Batch#          Type                Size/Fit        Quantity Made       Location

DDMMYY001       Winglet Strut       A380            3                   Dubai

DDMMYY002       Rudder Pin          12x100          5                   Paisley

End of List

Press any key to return to the menu
```

```
Welcome to the PPEC inventory system

Choose an option:

    6.  Create a new batch
    7.  List all batches
    8.  View details of a batch
    9.  View details of a component
    10. Quit

>>> 3

Enter batch number: DDMMYY0001

Batch Number: DDMMYY0001

Location: Dubai

Manufacture Date: DDMMYYYY

Component Type: Winglet Strut

Component size/fitment type: A380

Number of components in batch: 3

Serial Numbers: [DDMMYY0001-0001, DDMMYY0001-0002, DDMMYY0001-0003]

Component status: [

                DDMMYY0001-0001 Manufactured-unfinished,

                DDMMYY0001-0002 Manufactured-unfinished,

                DDMMYY0001-0003 Manufactured-unfinished

                ]

Press any key to return to menu
```

When you have completed the coding of this step you should save the completed Python file as **Step3.py**. You should also create a testing plan for this step (as a section in your overall testing document). The testing plan must be accompanied by an example input data set, details of expected outputs and screen dumps from testing of your application as evidence of successful testing. The testing plan document, python file and *BatchIndex.json* file, and copies of the batch and component files used during testing should all be placed in a folder named Step3 following the folder structure shown in [WHAT TO SUBMIT](#).

STEP 4 (15 MARKS)

Build on step 3 by creating a copy of Step3.py and renaming it as **Step4.py**.

In this final step you will implement two additional functionalities. Firstly, you should implement a "*search by product type*" facility that will allow the user to determine if a particular product type/size/fit combination is currently in stock, together with the quantity, location and finish type(s) available. Secondly, you should add a facility to allocate a finish type (polished metal or paint code – 4 character code) to individual components that have a status of *manufactured-unfinished*.

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Allocate manufactured stock
    6.  Search by product type
    7.  Finish a component
    8.  Quit

>>> 8

Goodbye
```

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Allocate manufactured stock
    6.  Search by product type
    7.  Finish a component
    8.  Quit

>>> 6

Component Search

Select component type (1. Winglet Strut, 2. Door Handle, 3. Rudder Pin) > 1

Select Size/fitment type (1. A320 Series, 2. A380 Series) > 2

You selected A380 Winglet Struts is this correct Y/N? Y

No stock available!

Press any key to return to menu
```

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Allocate manufactured stock
    6.  Search by product type
    7.  Finish a component
    8.  Quit

>>> 6

Component Search

Select component type (1. Winglet Strut, 2. Door Handle, 3. Rudder Pin) > 1

Select Size/fitment type (1. A320 Series, 2. A380 Series) > 2

You selected A380 Winglet Struts is this correct Y/N? Y
```

The following winglets struts are currently in stock:

Finished Products:

Component Serial Number	Location	Finish	Manufacture Date
DDMMYY0009-0976	Paisley	Polished	DDMMYY
DDMMYY0023-1023	Dubai	Paint:BE43	DDMMYY
DDMMYY0709-0002	Dubai	Paint:AE96	DDMMYY

Unfinished Products:

Component Serial Number	Location	Finish	Manufacture Date
DDMMYY0009-0228	Paisley	Unfinished	DDMMYY
DDMMYY0023-1926	Dubai	Unfinished	DDMMYY
DDMMYY0709-0091	Dubai	Unfinished	DDMMYY

Press any key to return to menu

```
Welcome to the PPEC inventory system

Choose an option:

    1.  Create a new batch
    2.  List all batches
    3.  View details of a batch
    4.  View details of a component
    5.  Allocate manufactured stock
    6.  Search by product type
    7.  Finish a component
    8.  Quit

>>> 7

Enter serial number of the component to finish: DDMMYY0023-1926

You selected A380 Winglet Strut Dubai is this correct Y/N? Y

Select finish (1. Polished, 2. Painted) 2

Enter Paint Code: AJ74

Component number DDMMYY0023-1926 will be finished using Paint Code AJ74

Press any key to return to menu
```

When you have completed the coding of this step you should save the completed Python file as Step4.py. You should also create a testing plan for this step (as a section in your overall testing document). The testing plan must be accompanied by an example input data set, details of expected outputs and screen dumps from testing of your application as evidence of successful testing. The testing plan document, python file and *BatchIndex.json* file, and copies of the batch and component files used during testing should all be placed in a folder named Step4 following the folder structure shown in WHAT TO SUBMIT

ADDITIONAL ASSESSED COMPONENTS

The above 4 steps account for 60% of the marks for this coursework, the breakdown of the remaining 40% is given below.

- **Programming style and organisation – (10 marks)** - Awarded for clear, well organised and commented code with all sources referenced using comments.
- **Extra Credit – (10 marks)** - Awarded for using more complex, and varied input methods (e.g. a range of EasyGUI widgets), providing a well-designed user interface, evidence of self-directed study of Python such as introducing features/packages/modules not covered in the lectures.
- **Testing plan and evidence – (10 marks)** - Awarded for providing an effective, well documented testing plan for each step in the development supported by evidence of testing having taken place (outputs such as screenshots)
- **Individual critical appraisal – (10 marks)** – Awarded for provision of an insightful and reflective discussion of the project development work including any notable achievements or shortcomings.

PROJECT DOCUMENTATION

The project documentation should consist of a single testing plan for the project and individual reports from each member of the team. This individual appraisal should provide an insightful and reflective discussion of the project development work including any notable achievements or shortcomings. It should detail how the workload was shared between team members. Further guidance on preparation of the testing plan and individual critical appraisal will be provided as separate documents on Moodle.

PYTHON VERSION

All work should be carried out using Python version 3.4 or greater. Submissions using any version of Python 2 (e.g. version 2.7, which is still the default installation on many Apple and Linux devices) are not acceptable.

WHAT TO SUBMIT

You will submit all coursework project files as a single ZIP file. Your submission should consist of a hierarchical folder structure conforming to the structure shown in the diagram below. The top-level folder (**and your zipped file**) should have your banner ID as its name e.g. B000123456 for a single submission or B000123456_B000123789 if submitting as a pair). The documentation folder should contain your individual critical appraisals, each named with your banner ID e.g. B000123456_appraisal. Each of the folders Step1 to Step 4 should contain three sub-folders as shown in the diagram. In the data folder you should include at least three different examples of any data files used for testing and validation of your code at this step of your implementation. The code subfolder should contain your Python file e.g. Step1.py and the Testing folder should include your test plan for this step (as either a Microsoft Word document (.doc or .docx) or as a pdf file) and any evidence of successful testing such as screen shots etc.. The project code files (. py) and associated data files (you must include at least three example data files) should be submitted along with the project documentation (either as a word document or a pdf) to the appropriate assignments page on Moodle.

N.B. Your banner ID(s) should appear in the text of EVERY document/file submitted (e.g. in the comments in project code or as a header in any word document – so that it appears on every page)
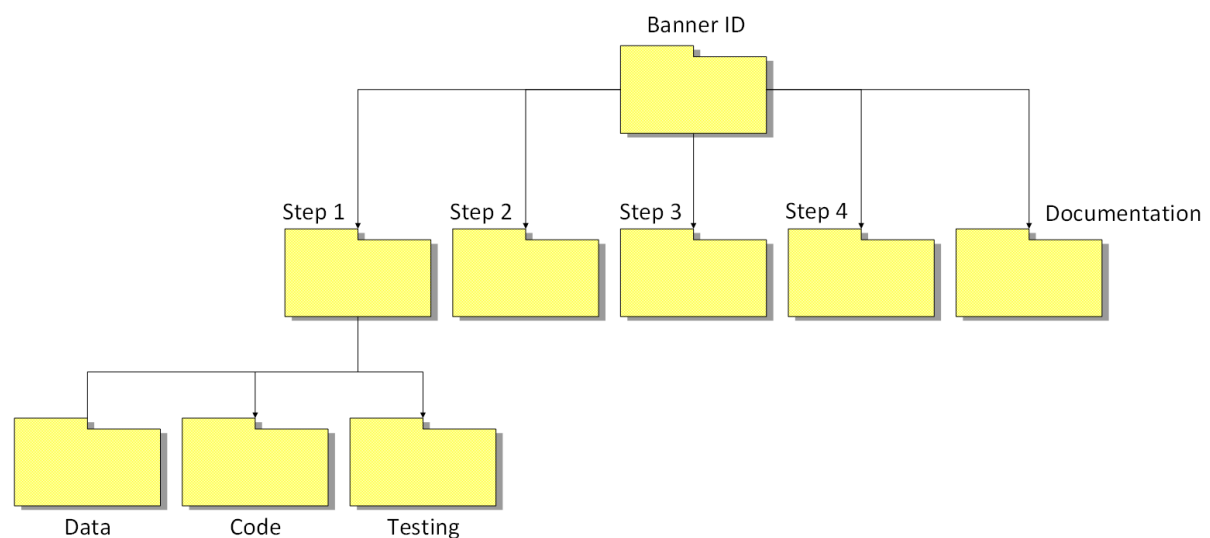
HOW TO SUBMIT

Submit all of your project files in a single ZIP file.

To do this:

- Make sure that you have an appropriate folder and file structure that follows the diagram above.
- Create the project in your Python environment of choice and fully test it using the folder structure above.
- Create the documentation as a Word document or PDF. Remember to add your Banner ID(s) to this document.
- ZIP the top-level folder in Windows Explorer by right clicking on it and selecting Send to… Compressed File
- Go to the Moodle Assignments and click on Final Project Submission
- Attach your ZIP file using the Add Submission button
- N.B. The ONLY acceptable compressed file format is .zip (created using the above instructions) DO NOT submit using other file formats such as .7zip or .rar.

WHEN TO SUBMIT

The deadline for the project submission is **Sunday 15th April 2018 at 23:59.** Projects submitted later than this will be subject to the normal university late submission rules (up to 1 week late, a reduction of the assessed mark by 10 percentage points; later than this, a submission will receive a zero mark).

N.B. It is always a good idea to submit a few hours early, the submission system on Moodle is often very busy at this this point in the trimester. If, for any technical reason, you are unable to submit to Moodle you must email your submission (with attached zipped folder) to your lecturer (james.nightingale@uws.ac.uk) **before** the deadline explaining why you were unable to submit via Moodle.