ECM1400 Programming
Continuous Assessment 3

Date set: 1st November, 2019
Hand-in date: **11:59am Friday 6th December, 2019**

This continuous assessment (CA) comprises 30% of the overall module assessment.

Note that both paper (BART) and electronic submissions are required and instructions are provided at the end of the specification. Students have until 8th November to raise any questions regarding the specification either in lectures or by email. Up to this date the module leader may make adaptations to clarify the assessment. After this date the specification will not change.

This CA is designed to test the programming concepts that we will cover in the entire module. This assignment will require the application of fundamental programming constructs, control flow, data structures and design patterns, to solve real world problems with an industry stakeholder.

Specification

Barnaby's Brewhouse are an organic microbrewery based in Totnes Devon. They are curretly undergoing an expansion to increase their production facilities and as part of their expansion are looking to develop a system to predict demand and help montior and schedule their brewing processes.

Brewing beer is one of the oldest biochemical processes in the world. The production process has been refined over thousands of years and a modern brewing process requires precision timing and careful planning to consistently produce a high quality product.

In this assignment you will merge static information, such as an equipment list, with time series information, such as sales over a given period of time, along with current state information, such as the production stage of each batch, to produce a system that can be used to monitor and augment the planning decisions of the brewhouse.

Following a requirement gathering exercise the following features were agreed as the requirements for the system.

- **Sales predictions**

  Demand for particular types of beer varies from week to week and month to month. Due to the lead time taken to produce each batch of beer, up to 10 weeks, it usually isn't possible to produce beer after orders are received so it is important to be able to predict

demand for beers in advance. 12 months of sales have been provided in the file named `Barnabys_sales_fabriacted_data.csv` on ELE. Customer information has been fabricated to avoid privacy concerns.

Write a module to read the file structure and load the data into a suitable data structure in Python. Interpret the data by calculating the average growth rate, the ratio of sales for different beers and use these values to predict sales for a given week or month in the future.

[10 marks]

- **Brew process monitoring and inventory management**

  Brewing beer is all about timing. The brewing process involves four stages that often need to be carried out on different equipment. It is critically important to move produce between the stages at the right time and to keep track of what produce is where. Barnaby's produces three main beers:

  1. Pilsner
  2. Dunkel
  3. Red Helles

  There are four stages to the brewing process, two of which have to be completed on tracked equipment:

  1. Hot brew - this stage cooks the ingredients ready before fermentation. It is done on a single piece of equipment and can be done within a few hours.
  2. Fermentation - this stage takes on average four weeks and needs to be done in a tank with fermenter capability.
  3. conditioning and carbonation - this stage takes up to two weeks and needs to be done in a tank with conditioning capability.
  4. bottling and labelling - this stage takes a corresponding number of hours to the volume of the batch and doesn't require any equipment.

  Barnaby's currently has 9 tanks with following capacity and capability:

Name	**Volume (L)**	**Capability**
Albert	1000	Fermenter/conditioner
Brigadier	800	Fermenter/conditioner
Camilla	1000	Fermenter/conditioner
Dylon	800	Fermenter/conditioner
Emily	1000	Fermenter/conditioner
Florence	800	Fermenter/conditioner
Gertrude	680	Conditioner
Harry	680	Conditioner
R2D2	800	Fermenter

  Write a Python module with the relevant data structures that captures the information required to track brewing processes on the equipment listed, for the beer listed, recording how long each batch has been at each production stage in each piece of equipment. Finally the module should also keep a record of the number of bottles of each beer currently bottled and ready for delivery.

  [10 marks]

- **Planning algorithm**

  Barnaby's brewhouse produce a range of beers and have limited facilities. Write an algorithm that decides what beer should be produced next given the available facilities based on the predicted demand.

  [10 marks]

- **Project delivery**

  This system is designed to be used in the brewery so reliability, clarity and simplicity are key. Add a basic interface to enable an operator to 'upload' new sales data, input new batches, change the production phase of existing batches and 'register' and 'dispatch' customer orders. Include a feature to recommend the next beer to brew when a tank becomes empty.

  This software has a stakeholder/client that will use the software so requires a 'handover'. The source code should be easy to navigate be provided with a clear readme file explaining how the system can be deployed and used.

  [10 marks]

You should carefully follow the functionality described. Note the implementation requirements intentionally do not include implementation details and you should be prepared to explain how you have adopted particular design patterns and made design decisions to achieve given features. You should also provide full handover documentation so that the software can be taken over by the stakeholder without further consultation from the developer (you).

Submitting your work

The CA requires demonstration and paper and electronic submissions.

Paper You should submit a paper copy of your formatted source code and a single screenshot of your user interface to the Harrison Student Services Office in the foyer of the Harrison Building by the deadline of **11:59am Friday 6th December, 2019**.

Paper submissions should have the BART cover sheet securely attached to the front and should be anonymous (contain your student rather than your name).

Electronic You should submit your source code and any supporting files via the electronic submission system at `http://empslocal.ex.ac.uk/submit/`. Use the category containing ECM1400 and CA3. Upload a compressed version of your files as a single file, use the `zip` compression format.

After you click proceed you will be sent an email by the submit system asking you to confirm your submission by following a link. Your submission is not confirmed until you do this. It is best to do it straightaway, but there is a few hours leeway after the deadline has passed. It is also possible to unsubmit and resubmit electronic coursework — follow the instructions on the submission website.

Both paper and online submissions must be completed by the deadline else your submissions will be considered late and your mark will be capped at 40%.