Multi- Paradigm Programming

This assignment will compare and discuss the C procedural programming language with the Java object orientated programming language. A shop program will be developed in order to compare both programming languages.

The program will contain the following functionality,

- Read in two CSV files. One for the shops stock and one containing the customers orders.
- Update the cash in the shop based on the money received
- Process or reject a customer's orders based on stock level or a customer's budget
- Operate in a live mode to process or reject a customer's orders based on stock level or a customer's budget

Programming Paradigms

Programming paradigms are used to classify programming languages based on their features. Object oriented programming and procedural programming are two examples.

Procedural Programming

Procedural programming is a programming paradigm based on the procedure call. The paradigm consists of a series of computational steps to be carried out. The focus is of procedural programming is to breakdown a task into variables, data structures and subroutines. The C programming language is based on procedural programming.

Object Oriented Programming

Object orientated programming is a programming paradigm based on objects. The object includes the data types of a data structure and the functions that can be applied to the data structure. Relationships can be created between objects. The Java programming language is based on object-oriented programming.

Procedural and object-oriented programming compared

Procedural Programming	**Object Orientated Programming**
Divided into functions	Divided into objects and classes
Top down approach	Bottom up approach
No access specifier	Private, protected and public specifier
Complex to add additional functions	Easy to add additional functions
Cannot hide data - Unsecure	Can hide data - secure
Complied language	Interpreted language

Gabbrielli et al (2010)

Shop Program Comparison

Creating Structure and Classes

The first step of creating the shop program using the C programming language, was to define all the related variables. Four structures were created for the customer, product, productstock and the shop. The structures were created based on the known relationships between the variables. This image displays the product struct in C.

```c
// A product structure is created with product name and price
struct Product {

    // Char* returns the memory adress of the variable containing letters
    char* name;
    // double assigns the datatype of a variable with two decimal places
    double price;
};
```

In Java the first step of creating the shop program was to create individual classes for each class type. This required creating four separate files and naming each of these after the class created. Each class contained private and/or public objects. Within the classes the variables and datatypes were defined. In addition to this within the class, methods were also created. For the private class's getters were required to allow the user to modify this class, if required at a later stage. This image displays the product class in Java.

```java
package ShopVideoVersion;

public class Product {
    private String name;
    private double price;
```

Comparing the first two steps, the approach was similar. Both created the variables and defined their datatypes.

Reading in the CSV files

The second step consists of reading in the two CSV files one containing the customers data and the second containing the stock data.

In C two additional structures were created to read in the csv file. The length of the file was set and each variable within the file was categorized as a datatype. Memory was allocated were the length of the datatype was unknown.

```c

//Read in shops stock and cash float from a CSV file
struct Shop createAndStockShop()
{
    FILE * fp;
    char * line = NULL;
    size_t len = 0;
    size_t read;

    // Open file & read in detail
    fp = fopen("stock.csv", "r");
    if (fp == NULL)
        exit(EXIT_FAILURE);

    //This gets the first line of the file
    getline(&line, &len, fp);

    // Assigns the first line as cash in the shop and converts the string to a floating point number
    double cashInShop = atof(line);

    // This assignes variable shop to cashInShop
    struct Shop shop = {cashInShop};

```

In java Java.io was used to read the whole file into a list. The length of the file did not need to be set and the datatypes did not need to be set. The main method was used to add the file location

```java
package ShopVideoVersion;

import java.io.IOException;

public class Shop {

    private double cash;
    private ArrayList<ProductStock> stock;

    public Shop(String fileName) {
        stock = new ArrayList<>();
        List<String> lines = Collections.emptyList();
        try {
            lines = Files.readAllLines(Paths.get(fileName), StandardCharsets.UTF_8);
            System.out.println(lines.get(0));
            cash = Double.parseDouble(lines.get(0));
            // i am removing at index 0 as it is the only one treated differently
            lines.remove(0);
            for (String line : lines) {
                String[] arr = line.split(",");
                String name = arr[0];
                double price = Double.parseDouble(arr[1]);
                int quantity = Integer.parseInt(arr[2].trim());
                Product p = new Product(name, price);
                ProductStock s = new ProductStock(p, quantity);
                stock.add(s);
            }

        }
```

Comparing the second step it was a lot easier to import the files using Java's IO package. In C it was more complex as you are required to define the variables, datatypes assign memory and define the length of the file.

References

Programming paradigm- https://en.wikipedia.org/wiki/Programming_paradigm#Procedural_languages [Accessed 16/11/19]

Object Orientated - https://www.webopedia.com/TERM/O/object_oriented_programming_OOP.html [Accessed 16/11/19]

Gabbrielli, M., & Martini, S. (2010). *Programming languages: principles and paradigms*. Springer Science & Business Media.