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ICT40515 Certificate IV in Programming

[Let’s](https://opencolleges.my.salesforce.com/a0QE0000009b11Z) get programming with C#

**SP5/Module 8 Assessment**

ICTPRG406 Apply introductory object-oriented language skills

ICTPRG415 Apply skills in object-oriented design

ICTPRG413 Use a library or pre-existing components

Assessment: 33129/01

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**Assessment task 33129/01**

## Introduction

This assessment will test your skills and knowledge gained through completing the learning and activities in **Module 8: Let’s get programming with C#.**

This is a two-part assessment.

In the first part of the assessment, you will answer a number of questions which will test your knowledge on C#, Object Oriented Design and Reusability.

In the second part of the assessment, you will analyse a requirements brief and develop an application in Visual Studio and C#.

**Note – you must successfully complete ALL assessments (33129/01 and 33129/02) and have been assessed as competent in the previous assessments (33128/01 and 33128/02) from Module 6, Analyse Software Requirements and Module 7, Technical documents to achieve competency in:**

***ICTPRG406 Apply introductory object-oriented language skills***

***ICTPRG415 Apply skills in object-oriented design***

***ICTPRG413 Use a library or pre-existing components***

**Short answer questionnaire**

Answer each of the ten (10) questions. Do not write any more than 100 words for each question.

Rename this document to: StudentNumber\_C#\_33129-01 C.docx. For example, 665437\_C#\_33129-01.docx.

Provide answers in the space under each question.

1. Describe the processes and techniques related to object-oriented programming, including the concepts and language used.

Answer:

OOP (Object-Oriented Programming) is system whereby Data (variables) and code (Methods) to interact with that data, are combined within a Class definition and what other classes can access (Encapsulation)1. An Object created from a Class is the process of instantiation. Objects are where data is stored.

Constructors are a Method which assign data to and recall data from an Object. Inheritance is the process of extending / altering a Parent Class by creating a Child Class. Polymorphism is the process of a Class performing in a different way depending on how it is created.

1 <https://en.wikipedia.org/wiki/Object-oriented_programming>.

1. Describe the process of developing small-size applications.

Answer:

One process for developing small programs would be via the Waterfall model (<https://en.wikipedia.org/wiki/Waterfall_model>). This is a linear approach from start to finish the steps being “Conception, Initiation, Analysis, Design, Construction, Testing, Deployment and Maintenance”. Each stage is completed prior to moving onto the next stage. Due to the structured approach, one benefit is it allows for early stages to highlight potential issues later. This approach does not allow for ease of change within the development cycle.

Another process is Agile. Each of these approaches has their benefits and disadvantages and need to be considered on a project basis and more importantly the involvement of the client along with the initial understanding of the expected result.

1. Identify and outline the key features of a graphical user interface (GUI) for interaction with a user.

Answer:

GUI’s utilise a computers graphical capability to interact with a user through various components. These include the Desktop (the work area which generally contains multiple items), Pointer (utilised to select an object within the Desktop), Pointed Device (generally a mouse although other external items can be used in this case – VR, Trackballs, Tablets), Windows (sub screens which are objects within the Desktop area used to separate individual processes), Menus (commands selected via the Pointer or through various keypress combinations). GUI’s allows users to interact with the environment without knowing specific commands. (<https://www.webopedia.com/TERM/G/Graphical_User_Interface_GUI.html>)

1. List how you would select, evaluate and document re-use components intended for a project. Detail the issues associated with implementing a re-use component. Ensure you explain how the functionality of the reuse component fits with what is required by the parent project, the cost considerations and how you would document your process of evaluation and decision. (this answer can be up to 200 words).

Answer:

The publication NATO STANDARD FOR SOFTWARE REUSE PROCEDURES (NATO), provided systems to identify and reuse components developed within their IT environment. At the time, there was no concept of external repositories and sharing of code globally.

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Description automatically generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RD0RXhpZgAATU0AKgAAAAgABAE7AAIAAAAOAAAISodpAAQAAAABAAAIWJydAAEAAAAcAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAExhbmNlIEZsYXRtYW4AAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzUyAACSkgACAAAAAzUyAADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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1 have provided a visual representation of the steps for assessing the framework reusability.

The first step is within the design stage where a suitably competent person would evaluate the requirements document. This would highlight individual parts of the overall problem and allow initial selection of applicable components already within the programming environment.

<https://www.researchgate.net/publication/2760352_Reuse_Documentation_and_Documentation_Reuse> provides a thorough analysis of documenting a reuse component. Depending on the level of complexity of a project may determine the depth of information that is used to evaluate a reuse component. A generic reuse component evaluation document might be suitable.

Potential issues should be highlighted within the document. Monetary and time cost implications should be weighed against the total project cost and whether it is more effective to create this internally. There are many repositories available and locating a suitable component may require external assistance from an experienced programmer or cost extra time.

The main aim for using a reuse component is to ensure it fits within the requirements of the project. If the component does not function as required, it may not be suitable or may require adaptation of the item.

1 Evaluation of Framework Reusability article by Guido Cardino† , Francesco Baruchelli† , Andrea Valerio published in ACM SIGAPP Applied Computing Review - Special issue on frameworks and patterns in software reuse Homepage archive Volume 5 Issue 2, Sept. 1997 Pages 21-27

1. Describe a repository tool and the ways in which it can be used for a project.

Answer:

GitHub is an example of a repository tool. It is a central place where software is stored and accessed by numerous people within a project team (closed) or alternatively accessible as a general place for open source projects and tools which can be added into a project or used standalone through via the programming language it was written in.

1. Describe generalisation, specialisation, inheritance, aggregation and composition in object-oriented programming.

Answer:

Generalisation is the process of looking at “two or more subclasses and combining their duplicate characteristics into a generalised base class (super class)”.

Specialisation is the process of “creating subclasses from existing base classes”.

Inheritance is the process of extending a class (parent) into one or more classes. These derived classes are known as child classes.

(<https://www.infoworld.com/article/3032175/application-development/exploring-generalization-specialization-and-dependency-in-oop.html>)

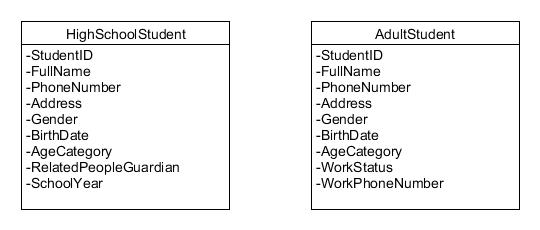
Association relates to a “‘using’ relationship between two or more objects in which the objects have their own lifetime and there is no owner”. The example provided was a Doctor / Patient. Each can have multiple of the other type but are not dependant on either existing.

Aggregation this is a parent / child relationship whereby each object is associated but also exists independently. E.g. Department / Employee – here an employee would still exist even if a department object was destroyed.

Composition is also a parent / child relationship where “if the parent object is destroyed, then the child object also ceases”. E.g. a House / Rooms – in this case the room object could not exist without the house parent.

(<https://www.infoworld.com/article/3029325/microsoft-net/exploring-association-aggregation-and-composition-in-oop.html?upd=1543646487858>)

1. Below are two classes that describe a Student. Students can be ‘High School Students’ or ‘Adult Students’. Study their attributes and suggest a superclass named *Student* that is derived from the two suggested subclasses below. Apply generalisation techniques to identify the attributes of the superclass. The attribute *Related People (Guardian)* refers to the person that is responsible for the student up to age 18 and *Work Status* refers to adult students who can possess the following values: Unemployed, Full time, Part time and Casual. Create the *Student* class and the *High School Student* and *Adult Student* subclasses.

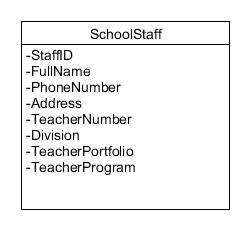


Answer:

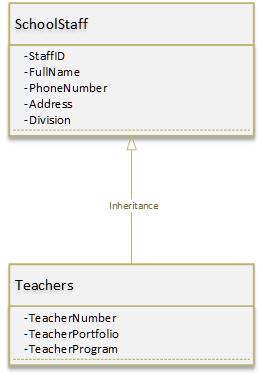
A screenshot of a cell phone

Description automatically generated

1. Below is a class that describe a School’s staff. School’s staff can be administration staff or teachers. Identify the subclass for *Teachers* by applying the technique of specialisation.

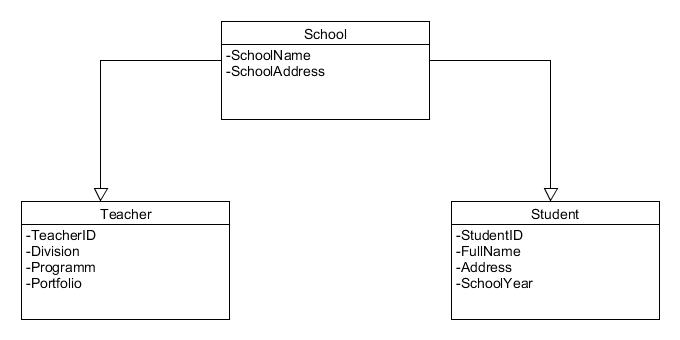


Answer:



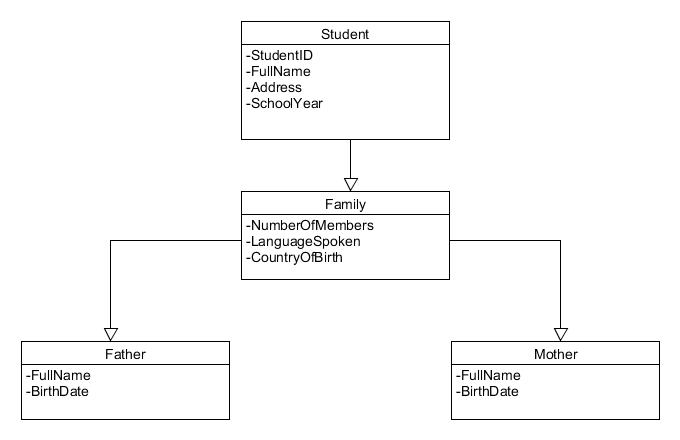
If the Division for a record was set to “Teacher”, then the Teachers Class would be created for the information.

1. Examine the class diagram below. Is it an aggregation or a composition? Explain why.



The above Class structure would be considered an Aggregation association. The Teacher and Student Classes are associated to School but are independent of this Class and could exist if the School Class was removed. There is a Parent / Child relationship, but they can exist independent of each other. (<https://www.infoworld.com/article/3029325/application-development/exploring-association-aggregation-and-composition-in-oop.html>)

1. Examine the below class diagram. Is it an aggregation or a composition? Explain why.



This could be considered an aggregation and a composition but at separate levels. The link between Student and Family is a weak link. If broken, the Family Class could still survive independently as Family isn’t directly tied to the Student information. This would be considered an Aggregation.

If the Family class was removed, then the Father and Mother Classes would cease to have relevance as they are linked strongly through the Family Class. This would be considered a Composition. (Reference as per link in Q9).

**Next steps for you:**

You have now reached the end of this assessment.

Ensure that you have answered all of the above questions.

Upload this document to OpenSpace. Label your file your StudentNumber\_C#\_33129-01.docx. E.g. 665437\_C#\_33129-01.docx.

Your trainer will provide you with feedback for this assessment.