*The questions:*

***C++ and OOP***

*Explain what is meant by encapsulation.*

1. *Encapsulation is a process of combining data members and functions in a single unit called class. This is to prevent the access to the data directly. The access to them in provided through the functions of the class. Popular feature of object oriented programming that helps data hiding*
2. *How it’s done?*
3. *Make all the data members private*
4. *Create public setter and getter functions for each data member in a way that the set functions set the value of data member and get function to get value of data member.*

*Explain what is meant by inheritance.*

1. *The ability for a class to derive properties and characteristics from another class is called inheritance.*
2. *Object oriented programming*
3. *Subclass: the class that inherits properties from another class is called subclass/derived class*
4. *Superclass: the class whose property are inherited by subclass is called the base class or superclass*
5. *Eg class bus class car class truck*
6. *We would need to write about fuelcapacity(), topspeed(), no of wheels() for all but using vehicle class, these can be inherited.*

*Explain what is meant by polymorphism.*

1. *Polymorphism means having many forms. It is the ability for a message to be displayed in more than one form. In c++, polymorphism can be divided into two parts.*
2. *Compile time polymorphism – function overloading or operation overloading*
3. *Runtime polymorphism – function overriding, when one of the member functions of the base class. That base function is said to be overridden*

*What are templates?*

1. *Templates are a tool used to pass data types as a parameter so that we don’t need to write the same code for different data types. For example, a software company may need sort() for different data types. Rather than writing multiple codes, we can write one sort() and pass data types as parameters.*

***Version control, git and GitHub***

*What is a version control system, main advantages of using one?*

1. *A version control system like GitHub is a software that allows any developer to store, change and update software that he/she is currently working on. It works by having a centralised online repository which anyone can access, given they have the URL and they can download all the file within the online repository to their own computers which is called the local repository. Then can then work on the files and upload them back onto the online repository for safe keeping or for when someone else needs the code.*
2. *Main advantages of using an online repository is so that you can store the code of any project there, the necessary files etc. it also means you can go back and access any version of that same code and see where you made changes in the past.*

*Explain the procedure you would follow to obtain a copy of an online git repository, make some changes and then update the online repository with the changes themselves.*

1. *I will answer this problem in 2 ways. The first way is when you are working on your own and the second is when you are within a group*
2. *When you are on your own, it is easy to do. Firstly you must make sure you have the git software downloaded on the computer and if you do not, you must do that first. Secondly, open up the GitHub repository on the browser and copy and paste the link of the repository you want to change. Next you can open the git bash software and you want to first go to where you want the file to be stored at: in my case, it will be the desktop. So you enter cd into desktop*
3. *Next you can either clone the folder by using git clone or you can use git pull if you are working on computer you have already been working on.*
4. *Then cd into the file you are going to change.*
5. *Make all the changes you need within those files and check that they are ready to be committed and also uploaded*
6. *You do this by git status and git add . to add all the files.*
7. *Git status again will show you the files that are ready to be committed*
8. *Using git commit –m “Message” will commit the changes. Note that if you have been using a computer where you have originally signed in then then you won’t need to configure the settings using git config global then adding username and then the password.*
9. *After editing, you press git push and it’ll push the changes onto the remote directory. If you wasn’t previously signed in, it’ll ask for authentication but after that it’ll then push the changes through.*
10. *The second way to do it is if you are working as part of a team and a group.*
11. *You have to have adequate access to the repository in order for you to be eligible to fork the repository and make changes.*
12. *When you do this, you can clone your fork to your local directory to make changes.*
13. *After you do this, you can edit the document on you local repository and push the changes to the main repository.*
14. *Then you go online and press, new pull request and then that will send the pull requests to the group leader and they can either accept or deny the request.*

*What is fork on git, how do you create a fork and obtain a local copy of the fork onto your computer*

1. *A fork is basically a copy of a repository. Forking lets you make changes to the project without affecting the original document but if the original document changes, your fork will not change with it so it is important to update the fork by recloning the repository if you need to change something*

*You have a fork of a GitHub project on your local computer that you have been working on, but the original project has changed. How would you update your local fork?*

1. *Updating a fork in GitHub is done by using a pull request. GitHub will then compare the base fork with yours and will find nothing if you have made no changes but if you have,*

*What is the difference between and pull and a fetch operation in Git?*

1. *In its simplest terms, git pull does a git fetch and a get merge. Git fetch is normally used when you want to update your branch when working with a group project.*

*What should and shouldn’t be uploaded to a Git repository and why?*

1. *There are some files that should not be uploaded to the git repository. These files are normally compiled codes, hidden system files, compiled code and dependency caches. In order to tell git not to upload these, a git ignore file is normally added to the repository to clean it up. Git ignore file can include .com, .dll, .exe, .o, .so and many other files. This is simply a project management tool so the developers do not interfere with these files.*

***Building software***

*Explain the differences between static and dynamic libraries.*

1. *Static libraries are libraries that are created when the build process is being done. They are libraries that are locked into a program at COMPILE time. Usually end with (.o). Dynamic libraries are built when the program is about to be executed. Usually end in a (.dll). they exist as separate files outside of the executable file.*
2. *Downside of using static libraries is that the code is locked into the final executable file and cannot be modified without needing to recompile the entire code.*
3. *Dynamic libraries live outside of the executable file, the program need only to make one copy of the library files at compile time. Using static libraries means every file must have the library’s files at compile time*

*Describe the steps involved in building a program using command line compiler tools.*

1. *There are three steps involved when building a program using command line compiler tools. Firs tis the build process, meaning the building of the source codes. Meaning coding either .c, .cpp and .h files. Then the configure process configures the necessary files either by making static libraries or dynamic libraries. So these can include, object files like (.o) and (.a) when using g++ and (.dll) for dynamic libraries. Lastly the linking process of these files is needed. You must always link these files using g++ -c and then the name of the file. The assembler will then link all these files and finally to create the executable, you use the exe command as well as the source code and the object files and create the executable.*

*When using CMake to build software that must be linked against a library (e.g. Qt or VTK), what configuration options might you need to supply to CMake?*

***Qt***

*Explain how user actions, such as the click of a button, can be linked to useful code in a Qt application.*

*You have created a Qt application with a GUI that was designed in Qt designer, the GUI*

*contains a checkbox. How might you determine the state of the checkbox from within the C++ code of your application?*

*You have an application with a Qt based GUI that includes toolbars and menus with icons.*

*How might these icons be stored/accessed by the application when it runs?*

*An application linked with Qt compiles without any errors or warnings but when you try to run it from within Visual Studio it will not launch. Why might this be?*

***VTK***

*What VTK classes must be used to render a simple object, e.g. a cube, in an application?*

*What is a vtkSmartPointer (or a smart pointer in general)?*

*How can vtkCell3D derived classes (e.g. vtkPyramid) be used to render 3D primitive shapes?*

*Explain how filters work in VTK.*

***Secondary Issues***

*What are unit tests and why might they be used?*

1. *Unit tests are a method of testing which individual units and components of a software are designed. The purpose of the unit tests are to validate that each part of the entire code is working and that there are no errors within the software before it is implemented. Unit tests are usually the first test conducted in a series of tests that include an integration test, system test and finally an acceptance test with the latte being the most important as it caters to the entire piece of software*

*How could you create documentation for your code?*

1. *Documentation of code can be split into two groups. The pre-production and post production. Pre-production code is normally documented by comments within code, readme texts and code that would not be seen by the customer. Post production code is normally the setup documentation, user manuals and marketing materials. Preproduction documentation can be done by software called dogygen which is a documentation generator for software. It does this by cross referencing documentation and code so that the reader can easily refer to the actual code.*
2. *Post production documentation isn’t as difficult as pre-production as it normally includes marketing documentation, user documentation and others so can be written based on the needs of the customers or software use.*

*You are generating a Windows installer for your software. How might you do this and what does the installer need to do/include in the install?*