**HOMEWORK WEEK 3**

This week’s homework is a research based one. You’ll need to conduct independent learning, in combination with existing material (where available), to answer the questions below. The reason for this homework is to ensure you are aware of critical topics in CS. These topics were difficult to cover within the existing lesson schedules, but due to their importance are placed within the homework instead. Make sure to research, learn and then answer the following:

1. **What is OOP? How have you already made use of it (e.g. class components)?**
   1. *Feel free to give a fairly light answer here - as you’ll need to do the deep-part / actual meat in the following questions when you cover each of OOP’s pillars*

Object Orientated Programming is way of structuring software design around objects or data and actions in the form of methods or functions. Objects are units of code which have distinctive attributes and they allow you to store data of all types together (which can be expressed as variables) and let you define and store functions. This also means that real world objects can be represented though code such as a robot or computer. An example of an object is a laptop screen where the attributes can be size or resolution and the functions can be to alter the brightness or to switch it on and off.

A class differs from an object, as a class is like a blueprint or a holder that defines the methods and properties of an object but it does not possess any data within whereas an object is a specific version of a class with the extra information/data such as what the methods will return and also the values of the properties. To bring the object to life and create an instance, the attributes must be set so that it can know what to do. Instances can be created without having a function for each one.

Class components in JS have these three features.

Constructor, methods and functions and data attributes.

1. Constructors are used to make new objects and instance of a class. They allow the attributes of an object so the object can be used.
2. Methods allow the object to execute actions specific to the objects.
3. Data attributes store information for the object.
4. **What is Polymorphism?**

Polymorphism is one of the core features of object-oriented programming languages. It denotes the capability of a function, variable or object to take on various forms. Polymorphic code enables a program to process objects in a different way based on their data type and class and can define methods for derived classes. A real-world example can be water which is liquid at room temperature, solid at low temperatures and gas at high temperatures. Water behaves differently in different temperatures but still has the same chemical formula and therefore is still water.

An object may have more than one form and can contain many data types. Polymorphism enables us to group these objects with the same parent and can let us insert various data types into one variable name. An example can be the classification of blood groups, if you have a A blood groups, and then B blood groups and O blood groups they can all be grouped within a common array called blood groups. We can therefore group things many items into an array using their different data types but singling out their similarities into one specific data type. This give the user the ability to loop through the arrays and consider each item (with similar data types) as if they have the same data type, but it also recognises there are difference between each item and will adjust accordingly to each item. An example of polymorphism is defining variables, so if I create a variable call name and set the string called ‘Jasia’ or name it as a boolean such as ‘false’ and the language guesses what the data-type is. Also when working with classes, Doctor can be a class, and Doctor ‘extends’ Person and can be a form of a person. So person can take many forms like patient, or radiographer.

1. **What is Abstraction?**

Abstraction requires to hide the details from the outside world. In OOP, it focuses on hiding complex and unnecessarily details from a user. It does this by identifying first patterns in problems and gathers general characteristics to filter out the details that are not required to solve the problem. In the real world, we can have a coffee machine which can make coffee and so the user knows how to use the machine by selecting the coffee using simple switches. Abstraction deals with this by hiding all the details of how the coffee is made such as adjusting the temperature of the water and the quantity of coffee required. So when coding the complexities of our software program, we can use abstraction to ensure the user does not have to experience any complicated code but can still use the program at a simple level with all its encompassing hard-core logic and function. For instance, with objects they may need to use the object processes but not understand the logic for those processes.

1. **What is Inheritance?**

Inheritance enables a class to inherit attributes and or functions of another class by sharing the code with several classes and it eliminates the need to write out that class several times. Therefore, when a class is created, if it has the same functionality and attributes within the class, the new class can inherit those attributes and functions. This reduces the overall code as the new class does not require new code to be written for its functionalities and this becomes particularly helpful when creating a more distinct version of the existing class. An example is when a person class can exist and an employee class and a customer class can inheritance properties and functions from the person class. In JS, the extends syntax can enable this.

1. **What is encapsulation?**

Encapsulation refers to attaching the properties with its related data and functions. An example can be that our body parts such as eyes, tongue, and ears allow us to perform bodily function such as seeing, tasting and hearing. They are properties which are bounded to their functions. Without encapsulating the data, the code can interact with other parts of the program and modify things or change things and the objects within can become very complex. Encapsulation can ensure the data is kept for specific functions and ensure they are maintained in a way where they do not overlap but also so other part of code can be easily used alongside the encapsulated coding. In OOP, we want to wrap variables and functions inside classes so that outside users do not access the field itself but the methods or values of the field. We can declare private variables in a class to not be used outside the class. So that some other class cannot access this variable directly unless some of the private classes are made public. This can ensure that the sensitive data is hidden from users. For example, with the two functions in the image, the ‘i’ would be encapsulated, the two ‘I’s would not interact and each I is only available to each function.

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Description automatically generated with low confidence

What is:

* 1. **Agile development?**

Agile development is an iterative way to encourage a product management team to work on a project in different stages simultaneously. The model, development and testing are all done simultaneously and allow more communication between the developers, managers, testers and stakeholders. The product is delivered in a way where the client can see parts (increments) of the project rather than the complete launch of the project. For the iterations, client feedback is used to development of the product and guarantee client satisfaction.

* 1. **Waterfall development?**

Is a software development methodology where a more linear approach and is used by dividing the project into stages like design, analysis, implementation and so forth. It is a method where things must be conducted in chronological order where one stage must be completed before moving onto the subsequent stage. For each stage, clear documentation must be updated, and the product is presented to the client once it is completed. There is also a stage-gate between the stages e.g where the client must approve things before the next stage begins.

* 1. **How do they differ? Which is suited for which situation?**

The waterfall method is much more suited to projects that have strict practices that that must be met. The aerospace industry has strict protocols that must be adhered to and usually choose waterfall over agile. It also is better for projects with a clear end goal. For example if the stakeholder knows wants to create a website for a rocket they will have already envisioned a plan and concept in advance. The initial launch may need some enhancements however which is not always ideal. It is a great method for the projects where the scope is known prior to the management. It may require a big team and therefore coordination may decrease within the team whereas agile usually relies on small teams with high coordination. The features within a waterfall project may not be prioritised and so the project may result in a complete success or failure. However with Agile, features are prioritised and usually the challenges faced are sorted out corresponding to their importance so therefore does not result in a complete failure. Ideally, stakeholder and customer satisfaction is of highest importance and priority as it is those people who will be benefitting the product, not the software team. So it is essential to customise the projects for the users. If the stakeholder provides clear documentation and idea of what they want in the beginning of the waterfall methodology, it is much more liked to gain success but if the stakeholder has limited research on what they desire then it makes it difficult for the teams to understand the goals to be met with less sense of direction and thus can lead to a complete failure of the product.

Waterfall development does not entail customer interaction while the product is in development, which may result in huge customer dissatisfaction as the product management team is not entirely aware of what the customer wants and so may produce results which differ to the general opinion of the target audience (customers). Although with agile, the customers are always notified during each incremental presentation, and this helps with project development as there is more of a chance of meeting the customer’s wants and guaranteeing that satisfaction. Agile ensures iterations are much quicker and waterfall looks at the comprehensiveness of the entire project. Agile relies on the customer’s feedback to make changes or alterations to the project whereas waterfall looks at trying to attain good results after the completion of the project.

Agile is preferred within the software industry with stakeholders involved in each step – it is far more flexible than the structured management method taken with waterfall. It is also great for creating new products as more testing and flexibility and experimentation can be done and so the teams can create more drafts that the stakeholder can look at and see if that is exactly how they wanted their project to be or if it is a complete miss. They stakeholder can also gain more ideas after that they may want to feature within the apps, and or learn that they need features that were not considered by the teams when looking at the prototypes and thus make suggestions/feedback to nurture the project to their desired product.

In conclusion, agile and waterfall play strong suits for different types of projects. Agile works better with a flexible and experimental environment where the team plans quickly. It also allows the stakeholder to see if the project is heading where they originally planned as sometimes the software team may misinterpret or understand things to be different to the stakeholder and this can all be rectified through the small incremental meetings that take place. Whereas with the waterfall team it works well when a well-defined goal is set in the beginning. It would be best to use waterfall methods for projects that are like previous ones or have a defined goal where the stakeholders know exactly what they want and how to ensure that the product team understands everything they desire too. With the agile methods, I think it can be used ubiquitously as it can really help the direction of the project to ensure that products are closer to the desired outcome of the stakeholder.

Once complete, please return to your instructor your answers! Remember:

* Justify and be critical of everything! This distinguishes a great answer from a good answer
* Analyse - why does x even exist? Who needs it or uses it? Who is it important to, what’s the point of it at all?