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| **COURSEWORK ASSESSMENT SPECIFICATION** |

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| **Module Title:** | *Implementation of Object Oriented Designs* |
| **Module Number:** | *KF7012* |
| **Module Tutor Name(s):** | *Mark Hurrell* |
| **Academic Year:** | *2018-2019* |
| **% Weighting (to overall module):** | *100* |
| **Coursework Title:** | *University Information Systems* |
| **Average Study Time Required by Student:** | *50 study hours* |

**Dates and Mechanisms for Assessment Submission and Feedback**

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| **Date of Handout to Students:**  8th October 2018 |
| **Mechanism for Handout to Students:**  ELP |
| **Date and Time of Submission by Student:**  7th January 2018 |
| **Mechanism for Submission of Work by Student:**  *ELP - Turn-it-in* |
| **Date by which Work, Feedback and Marks will be returned to Students:**  4th February 2018 (20 working days) |
| **Mechanism for return of assignment work, feedback and marks to students:**  Email |

**Further Information**

**Learning Outcomes tested in this assessment (from the Module Descriptor):**

**Knowledge & Understanding:**

1. Demonstrate in-depth knowledge and understanding of current best practice in the design and development of Object Orientated systems

**Intellectual / Professional skills & abilities:**

1. Design a system using advanced object orientated principles and methods, such as Behavioural, Creational and Structural design patterns, ensuring a high level of quality and data security.
2. Implement and test Object Orientated programmes using advanced techniques ensuring a high level of quality and data security.
3. Critically evaluate the effectiveness of implemented Object Orientated applications

**Personal Values Attributes** (Global / Cultural awareness, Ethics, Curiosity) (PVA):

1. Demonstrate a professional understanding of the importance of software quality in the development of applications.

**Assessment Criteria/Mark Scheme:**

See Appendix C for assessment criteria. Note that this work is worth 100% of the module and that the marks total 100 marks.

**Nature of the submission required:**

Individual work: The individual report should be a single document, and it must be in PDF format. You are required to upload this using Turn-it-in (ELP) as an originality report is required. Your work must be uploaded no later than 7th January2018. You should name this file so that it is clearly your individual work and should contain your student ID as part of the name.

Group work: A ZIP file should be created that contains your entire Visual Studio project, including the test project. Justifications of choices made such as patterns used and the data access layer need to be in a document. In the root of the folder should a file called group.txt this should contain the names of the group members.  
If you have used an Access database this should also be included in the ZIP file. Each C# software component should have the names of the group members within the comments at the top of the code. The ZIP file should also contain files for your Design (Task 2) and Testing (Task 4).

**Referencing Style:**

***Where you have used words from someone else (quotations), they should be correctly quoted and referenced in accordance to the Northumbria Harvard System. You will be required to submit the report for the work via turn it in.***

**Group work**

The size of a group is two students, you are expected to form your own groups by the end of teaching week 4. One member of each group must email the module tutor giving the names of the group members. Anyone without a group at the beginning of week 5 will be assigned to a group. In the rare event that a group is not working well together it may be disbanded. The module tutor will have final say when this occurs, It will only happen if there is sufficient documented proof that one member is not contributing to the work, in such eventualities it will be expected that you work individually on the assessment.

**Expected size of the submission**:

*Expected size of written work is stated on the individual sections.*

**Academic Misconduct:**

You must adhere to the university regulations on academic misconduct. Formal inquiry proceedings will be instigated if there is any suspicion of misconduct or plagiarism in your work. Refer to the University’s regulations on assessment if you are unclear as to the meaning of these terms. The latest copy is available on the university website.

Individual and Group components

Each task clearly states if the task is individual or group work. Submission of individual work will be at the same time as group work however these will be separate submission.

Peer Assessment and Group Diary

In order to complete the group work you will need to work with another student. It is important that you evenly distribute the work between yourselves and work effectively with each other. You are required to keep a diary so that you log and minute all communication and meetings. The diary will be required as part of the evidence in the portfolio.

You must also supply **one peer-assessment form for each group member**. **This will need to be agreed and signed by each group member.** The peer assessment template is available on the module web page. Completed forms need to be scanned or photographed and need to be uploaded as part of your group work assessment.

If the diary and/or individual peer assessment forms are missing then the group part of this assignment, will be capped at 50%. Based on the peer assessment form you will be able to calculate a score of between 3 and 8 which measures your peers views of the quality of your team work in this task. We reserve the right to consult with you and potentially change the weightings (and in extreme cases marks) when this is felt necessary. We will not do this before the assignment is handed in. On the form each student’s performance in the team is graded by a number of criteria. Each criterion will be given a score of between 3 and 8. Once all the 9 criteria have been graded the average score across the criteria for the student will be determined. This is called Team Work Score, which will be between 3 and 8. Calculate this by adding up the score for each of the nine criteria and then dividing by nine. Once the peer assessment forms have been completed for all members of the group it is possible to determine the group average. This is calculated by adding up the Team Work Scores for all the group members and dividing the total by the number of group members. A weighting can then be calculated by dividing the students Team Work Score by the group average. The weighting applies to only the group component of the assessment. A student’s mark will be determined by multiplying the group mark by the weighting. This will be calculated to the nearest whole number

See ELP Document “Example\_Peer\_Assessment\_Form”

**Assessment Scenario**

Case Study: Newcastle Production Diagnostics

*Background*

The manufacturing industry in particular reliant on bespoke machines, or specialist machines that have to be imported from around the world. These machines are often a mix of mechanical, electrical and embedded software controllers. The use of such machinery has allowed the food industry in particularly to revolutionize the way food is produced, however most modern manufacturing is heavily reliant on these specialist machines. Machines are used though the entire process from processing the raw ingredients/components all the way though to packaging.

The issue is that machines sometimes brake down, even when they are well maintained. If a machine fails, the costs to a company can be significant, as it may have to halt the entire production line until the machine is repaired. All companies who utilize these machines in their production have maintenance crews that are able to fix and replace worn out components. In the majority of situations, the maintenance crews are able to repair the machines without the need for using specialist repair companies.

It may also be possible for the production company (PC) to go back to the original equipment manufacturer for assistance in fault finding and repair, however this in not always possible, some machine makers have ceased trading while other may be located a considerable distance, such as in another country.

When a production companies (PC) own maintenance crew cannot affect a repair they must use a specialty repair company. These repair services are very expensive for a PC however; they are less expensive than a factory not making any products.

*System required*

Newcastle Production Diagnostics(NPD) is a specialist machine repair company. The company is not large however almost all of their employees are highly skilled engineers. The company have staff who have significant technical skills in the following domains: Electrical, Electronics, Mechanical, Hydraulic and Software.

The company also has a stock of common replaceable components such as sensors and motors. The company also has some capability to manufacture replacement parts. This includes some state of the art equipment for 3D scanning and printing as well as older technologies such as laths and . For larger mechanical pieces, the company outsources these to a few local companies who fabricate quickly for an additional fee. Electronics repair such as replacement of individual components on a PCB is again outsources to a local companies that are able to turn the work around quickly. The company prides its self of being able to repair machines in most instances. There are however occasions where repairs are not possible or successful. A determination as to whether the machine is fixable is taken early in the job. Jobs that are either unsuccessful or non-attempted are not chargeable.

The companies experience also helps when dealing with the original suppliers of the machinery. It may be necessary to obtain components or advise directly from the machine manufacturer, the companies engineers are best placed to do this as they have extensive engineering experience.

*Main Functional Requirements*

* Register client company
* Register a job for a client
* Automatically Schedule jobs with manual override.
* View current jobs.
* Record job progress.
* Assign Staff to job.
* Record outsourcing.
* Close job.

**Company Client/Job procedures.**

*Initial Recording*

* A production company (PC) which requires NPDs help to fix a machine must be a registered client. Registered clients are referred to as Client Company(CC). It is important that any potential CC registers as a client, as part of the registration process requires the CC to agree to NPDs terms and conditions. These include charging and many contractual clauses that limit the companies’ liability. For example NPD will not be held accountable for losses due to the CC production being delayed, even if NPD is a fault.
* When a new job in logged, the details of the job are taken such as the location of the factory, description of the machine, description of the fault. There is also an option to attach any video, pictures or schematics of the machine to the job. If these are unavailable at the time the job is logged, they can be added later. A check is performed to see if NPD has previously repaired the machine; in such eventualities, the job will also link to these previous jobs allowing the technical staff to review previous problems and solutions.
* The urgency of the job needs to be assessed when the job is first logged. Although every machine failure will be important to an individual company, the disruption caused to the CC has to be assessed by the person who is recording the job. This is on a scale of (0 – 5),

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| Urgency |  |
| 0 | Non-urgent jobs can be done during a quiet period, these jobs are done as a significant discount. These jobs must be started 90 days from when they were first logged. |
| 1 | Machines are still working but not working optimally for example, the quality of the products the machine creates may be lower than normal. These jobs must be started 40 days from when they were first logged. |
| 2 -5 | A machine is broken which is affecting the CC production ability. The scale of the affected production will be taken into consideration with choosing the values 2-5.  These jobs must be as soon as possible however first contact with the company is based on their urgency.  Urgency 2 – 14 days.  Urgency 3 – 7 days.  Urgency 4 – 3 days.  Urgency 5 – 1 day. |

* The last piece of information which is recorded is the machine size and complexity, Again a scale of (0 – 5).

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| Size and Complexity |  |
| 0 | Small low complexity machine, usually a single operator table top machine. |
| 1 | Machine is table top but complex. |
| 2 | Machine is medium sized and has medium complexity |
| 3 | Machine is medium sized with high complexity |
| 4 | Large machine with low complexity |
| 5 | Large machine with high complexity |

*Prioritization, assignment and scheduling.*

* Urgency is the primary factor used to determine where it is placed in the schedule. Jobs which have a higher urgency are normally place in front of jobs which have a lower priority. Lead times are calculated based on estimates from the current queue of jobs. The exception only occurs when the job has not been stated and it is approaching its must start date (see urgency table above). In such cases a lower urgency job will be scheduled before a higher urgency job, so that the job can start before the last permissible start date.
* When a job is first logged it is immediately sent to a technical manager who will give a base line estimate of the person days and resources required to complete the work. Only when the estimate has been completed, the job it can be scheduled.
* Lead-times ‘when a job is expected to start’ must be calculated dynamically and can change if either jobs overrun or jobs placed before them in the schedule.
* When the manager first logs into the system they should see all high priority issues on their main page this includes requests for estimates, and a list of problem jobs, these are jobs which have gone past their ‘must start date’ and should be highlighted in red. Those, which have gone over their initial estimates, these should be highlighted in yellow.
* The manager also needs to be able to view the list of jobs in a number of ways firstly to be able to filter this list on a number of different criteria such as expected start date, urgency, completed jobs, pending jobs etc.
* The manager also needs to see more detailed information about any of the jobs in the list. They should have the ability to view all the current information about the job such as updates, new estimates etc.

Job state change (process)

* A job has a life time on the system. When it is created, it goes into an initial state of ‘estimate needed’. Once the technical manager has given the initial estimate it goes to ‘pending’ and is placed in the schedule. The pending state signifies that there has been no contact between our company and the CC.   
    
  Once initial contact between one of the engineers and the CC support staff has occurred the job changes to ‘Active’. In an active state job can then be amended to record further details and any time which has been booked against the job (needed for billing purposes).  
    
  In some instances, the initial contact via video conferencing can determine the cause of the fault. This then allows the CC own technical team and affect a repair. Remote diagnostics changes the state of the job to ‘remote-solution’ and the job; there may be further contact with the CC technical team, each time this occurs it is logged against the job for billing purposes. Once a job that has been solved by remote diagnostics has been inactive for 5 working days. I.e. there has been no additional contact from the CC, the job is ‘closed’ and an invoice can be created.

If the job cannot be solved with remote diagnostics it will require a visit to the CC factory, a determination is made as to the team who will be needed and what equipment and spares they may need to fix the machine. Further discussion can take place with the CC if needed to determine the exact make up of this team. There are two main possibilities from this point.

1. The machine can be fixed by the team on their first visit.
2. The machine cannot be fixed on the first visit (this may be known in advance) the purpose of the first visit will be to remove/scan (3d scanners) any parts that require specialist repair or replacement by fabrication.

Where a second visit is needed the team which is sent the second time will typically be smaller in nature and the main propose will be to install the repaired/replaced component.

All activity needs to be recorded against the job, such as which staff have booked time against the job, what parts have been used/replaced in the machine, and what specialist repairs fabrication have been outsourced. The lead engineer also has the ability to change the estimate on the time it will take to complete the work. Note that this will affect the current schedule of jobs.

Assumptions.

There are 10 technical engineers available for work. One manager who is able to oversee the process.

***Task 1 Research Question (Individual Work) 30 marks***

This task is an individual task and covers the following learning outcome.

1. Demonstrate in depth knowledge and understanding of current best practice in the design and development of Object Orientated systems

In this task requires you to carry out some research. It is important that you use a range of quality sources and your findings and conclusions must be supported by the literature. The mark you are awarded is based on the quality of the research carried out, and principle conclusion you have drawn from the research you have conducted.

***Object Relational Mapping (ORM) is becoming more popular with developers as it simplifies development and allows the developers to create more functionality for a given cost. You should fully investigate the benefits and possible problems associated in using ORM technology. You must look into areas such as reducing development and maintenance costs, performance or ORM vs boilerplate data access layers, any criticisms of the technology such as whether it is an anti-pattern. Although in this module has looked at one particular ORM there are others on the market, such as Hibernate. Hibernate and Entity framework are both heavyweight ORM do they support the same patterns? There are also a number of light weight ORMs available, how do they differ from the heavy weight ORMs and what benefits/problems do they have over heavyweight ORMs .***

**References from good-quality, relevant literature must be used in order to strengthen any points that you raise in your discussion.**

Approximately 1500 words

**Task 2 UML Designs and OOP considerations (Group work) 10 marks**

This task assesses the learning outcome.

Design a system using advanced object orientated principles and methods, such as Behavioural, Creational and Structural design patterns, ensuring a high level of quality and data security.

Produce an implementable class diagram for the system you are developing, this should show your final design of the software components and clearly show architectural patterns used in the development of the system. You are expected to use Design Patterns in the creation of you product, and you are also expected to show layering of the application, patterns should be considered in each of the layers for example you are expected to use a presentational Patten in the interface layer. This work should only include the requirements which you are expecting to implement during the time-box.   
 (5 marks)

Justification, you must provide a justification for any of the patterns you have chosen to implement. Outlining reasons why the choices have been made, as well as any data security decision you have made. (5 marks)

**Task 3 Implementing the technical Solution (Group work) 20 marks**

In this task the following learning outcome is assessed.

Implement and test Object Orientated programmes using advanced techniques ensuring a high level of quality and data security.

You are not expected to try an implement the entire system. Agile methods require a subset of requirements to be taken into a time-box for development. You can apply MoSCoW to list of requirement, this will help you decide on what requirements you plan to implement. However you are expected to pick requirements which work together so that you can demonstrate a working subsection of the entire system, you should use vertical development.

A relational database must be used to store your application data. However you are expected to create an object orientated system. Therefore you must consider how the objects link to the database CRUD operations. Write a short justification as to the approach you are going to use. You are encouraged to use the inbuilt database within visual studio.

The system must be implemented using Visual Studio 2013 C# and the application must run on Visual studio 2013 professional in the lab. Other languages and/or platforms will receive a mark of zero.

Visual Studio 2013 professional is available to students to download via an elevated DreamSpark account (see module tutor if you are unsure how to go about this). You may include instructions as to use which would include any valid logon details or user details that you have created. You will be required to use a database for the development of the application, the only condition is that the application must run in the lab.

The code is marked on the following aspects:

* Scope Quality of technical implementation 15/20
* Justification and implementation of data access layer 5/20

**Task 4 Testing (Group work) 10 marks**

In this task the following learning outcome is assessed.

1. Demonstrate a professional understanding of the importance of software quality in the development of applications.

Testing should be carried out at the unit level, making sure the component works as expected, and at the system level using user requires (scenarios) as a basis for creating the tests. You should be both positive and negative testing.

Visual Studio provides an inbuilt testing framework, you are expected to automate as many of the tests as possible using the inbuilt unit testing framework. If you have used dependcy injection/mock objects to isolate classes you should make this clear in your stratergy.

**Task 5 Evaluation of the development process (Individual Work) 15 marks**

In this task the following learning outcome is assessed.

1. Critically evaluate the effectiveness of implemented Object Orientated applications
2. Demonstrate a professional understanding of the importance of software quality in the development of applications.

Many iterative methodologies incorporate an evaluation step at the end of each development time-box. The purpose is to reflectively evaluate the development increment so that lessons can be learned, and improve the development process in future increments. In this section you are required to critically evaluate development process and the tools used.

* Critically evaluate the approach you used in selecting what requirements in implement in the development time box, you should consider the logical grouping of the functionality and if you choose to many or two few requirements to implement.
* Teamwork, you need to critically evaluative how you’re team worked together in producing the technical solution. If any problems occurred they should be listed as well as any attempt to reach a resolution.
* Tool evaluation: Critically Evaluate: the development environment, database chosen and the use of testing tools in the development of the system.

Approximately 700 words

**Task 6 Evaluation of the technical solution (Individual Work) 15 marks**

In this task the following learning outcome is assessed.

1. Critically evaluate the effectiveness of implemented Object Orientated applications

Critically evaluate the Design and Implementation in relation to the object orientated principles covered in the module. You must consider the patterns you have used and discuss if they were effective and also discuss any patterns you have not implemented but believe to be relevant.

Critically evaluate your application in terms of security. Where you have identified a problem you should discuss technical solution needed to mitigate the problem.

Approximately 700 words

### APPENDIX C

## Marking criteria

**Task 1 Research Question (Individual Work) 30 marks**

The criteria used for marking will include:

* The quality and scope of the literature survey.
* The principle arguments and conclusions of the work undertaken.

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| Grade | Criteria |
| 70-100 % | The question will have been very well considered in terms its broad implications. Overall the work is concise complete and detailed, arguments and collusions made are well presented and backed up by literature. |
| 50-69 % | Work lacks some degree of scope, question has only been partially considered or it lacks the depth in its answer. Work may lack references or arguments and collusions are not backed fully backed up by literature. |
| 0-49 % | Work failed to address the question with any degree of depth or the work lacks sufficient references. Failure to reach a collusion based on rational reached arguments. |

**Task 2 UML Designs and OOP considerations (Group work) 10 marks**

**Implementable Class Diagram showing patterns and layers 5 marks**

**Justification of the patterns used or their absence 5 marks**

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| Grade | Criteria |
| 70-100 % | Diagrams are complete and are implementable. Patterns are clearly visible and are accompanied by a narrative which clearly states why they are being applied. Students are expected to show application split in two at least three layers. |
| 50-69% | Diagrams contains flaws which would affect the implementation. Patterns may not be well considered and the narrative explaining the rational lacks depth. The application layers are not clearly defined. |
| 0-49 % | Diagrams are incomplete or non-implementable and or the consideration of pattern is either missing or is poor. |

**Task 3 Implementing the technical Solution (Group work) 20 marks**

The criteria used for marking will include:

* scope Quality of technical implementation 15/20
* Justification and implementation of data access layer 5/20

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| Grade | Criteria |
| 70-100 % | A reasonable set of requirements are implemented given the time frame. Importantly the scope of requirements should not be at the cost to the quality. The system must demonstrate sound engineering principles such as the use of patterns in the all three layers of the application. Presentation layer should use a pattern to separate responsibilities or presentation and control. The system works with objects and is not data focused (object persistence in the database). Patterns need to be also evident in the domain layer. |
| 50-69% | Quality of the application and/or the engineering has problems such as failure to consider patterns in the presentation and data access layer. |
| 0-49 % | Scope and or quality of allocation are poor. There is little consideration of the implementation of patterns. |

**Task 4 Testing (Group work) 10 marks**

The criteria used for marking will include:

* Test plan based on user requirements both negative and positive testing's
* Tool based unit testing also with test plan.

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| Grade | Criteria |
| 70-100 % | Testing needs to be positive and negative in nature. Tests must be at a unit and systems level, fully documented and unit level should be fully implemented in Visual Studio in built test suite. |
| 50-69% | Scope of the testing is incomplete this may be due to poor choices of presentation pattern or a lack of scope in the tests chosen. |
| 0-49 % | Testing in incomplete or missing. |

**Task 6 Evaluation of the development process (Individual Work) 15 marks**

**Required items to evaluate**

* Critically evaluate selecting requirement.
* Teamwork
* Tool evaluation

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| Grade | Criteria |
| 70-100 % | Requirements, teamwork and tools have been critically evaluated and the work contains good arguments and reflections that would help to inform future iterations of the development. If there have been problems with the teamwork then a reflection as to why it occurred and what could be done to resolve such problems at an early stage should be discussed. |
| 50-69% | All aspects have been evaluated however the evaluation lacks the necessary depth needed to inform further iterations. |
| 0-49 % | Evaluation missing key elements or no real attempt to evaluate the work in detail. |

**Task 7 Evaluation of the technical solution (Individual Work) 15 marks**

**Required items to evaluate**

Design and Implementation in relation OO (patterns and principles).  
 Application Security including solutions to identified weaknesses. .

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| Grade | Criteria |
| 70-100 % | Overall an excellent evaluation of the technical solution, Identification and reflection of the weaknesses, as well and the achievements. This must include the OO considerations such where patterns were used to good effect or missing or incorrectly used. Security must be discussed including what needs to be protected via encryption |
| 50-69% | Satisfactory evaluation lacks some important items or lacks depth especially in offering alternatives or identification of weaknesses. Security evaluation has weaknesses in scope or type of security being recommended. |
| 0-49 % | Evaluation missing key elements and/or alternatives. |