Unit:
Professional Issues in IT

Assignment title:
[TBay- a safety critical system]

[Cycle] [Year]

Important notes

- Please refer to the *Assignment Presentation Requirements* for advice on how to set out your assignment. These can be found on the NCC Education website. Click on 'Policies & Advice' on the main menu and then click on 'Student Support'.
- You must read the NCC Education documents *What is Academic Misconduct? Guidance for Candidates* and *Avoiding Plagiarism and Collusion: Guidance for Candidates* and ensure that you acknowledge all the sources that you use in your work. These documents are available on the NCC Education website. Click on 'Policies & Advice' on the main menu and then click on 'Student Support'.
- You **must** complete the *Statement and Confirmation of Own Work*. The form is available on the NCC Education website. Click on 'Policies & Advice' on the main menu and then click on 'Student Support'.
- Please make a note of the recommended word count. You could lose marks if you write 10% more or less than this.
- You must submit a paper copy and digital copy (on disk or similarly acceptable medium). Media containing viruses, or media that cannot be run directly, will result in a fail grade being awarded for this assessment.
- All electronic media will be checked for plagiarism.

Scenario: A safety critical system

A system has been developed for the scheduling of maintenance at an airline company called TBay Airlines.

A trade union spokesperson for the airline maintenance workers argues that the to performing functions in in the new computer system there should be more **interactive human judgment** if safety is to be ensured. The program is one which schedules maintenance, and can reassign alternative aircraft when emergencies arise. The airline maintenance staff would be able to interact with the system, but only on a basic level.

The systems analyst, under whose direction the program was written, is aware that not all operational factors have been taken into consideration in the program, but he had been assured by management that the program conforms to all the requirements of the IATA (International Air Transport Association). In his opinion the program should have contained more interactive human judgement, so that a person is involved in the final decision making, but the company was not prepared to go to the additional expense of a fully interactive system.

When testing his program, he could not think of a scenario whereby the system couldn't meet a safety condition. When he was asked to testify in an inquiry dealing with the trade union's complaint, he did not volunteer his opinion on how the system should have been designed as he could not think of any negative outcomes that the system couldn't handle

Primary Participants:
Systems analyst
- designed program knowing that not all operational factors had been taken into account
- informed management of his concerns
- failed to volunteer his opinion when needed

Airline management
- disregarded analyst's concerns
- indicated 'decision rules' used in the program conform to IATA requirements
- opposed making system fully interactive

Implied Participants:
Programming staff
- implemented systems analyst's design

Task 1 – (15 Marks)

1a) List possible **ethical** actions that these three main primary participants (Airline Management, Project Manager and the Systems Analyst) could have done before they chose the path of action described in the scenario. Explain each action you have identified clearly. You must describe at least 4 actions and they be applied to the scenario. (Total 8 Marks) Word count **300 words** for the answer.

Award max 8 marks , one mark for any of the following actions and one mark for applying it to the scenario.

In the Scenario,
The Managing Director could have

- ***consulted the companies' Human Resources department to get their feedback on the proposed system because of the issues of Data Protection/ Privacy of information of the employees.***
- ***made the Project Manager/ Systems Analyst aware of any feedback from the HR Department***
- ***involved the employees themselves in the initial discussions.***

The Project Manager/ Systems Analyst could have, as a computing/IT professional, suggested involving the end users themselves in the initial stages because of the issue of the privacy of the information held on each employees PC.

1b) Standards as an IT professional are Essential. Identify a professional body that any of the main IT participants (Project Manager or the Systems Analyst) could belong to. Give a full description of the professional standards that are required by that professional body and relate them to the actions of the participants in the scenario. (Total 7 marks) Word Count 300 words.

Award max of 2 marks for correctly identify a professional body i.e. BCS, and whichever Professional Body is chosen then a full description of the code of conduct and the standards required by that professional body. They must be applied to the scenario. Award 2 marks for the full description, and 3 marks for applying it to the scenario.

e.g
ACM
BCS
IEEE etc

For the BCS:
Have due regard for public health, privacy, security and wellbeing of others and the environment;
Have due regard for the legitimate rights of third parties;
Conduct your professional activities without discrimination on the grounds of sex, sexual orientation, marital status, nationality, colour, race, ethnic origin, religion, age or disability, or of any other condition or requirement;

PUBLIC INTEREST
You shall:
Have due regard for public health, privacy, security and wellbeing of others and the environment;
Have due regard for the legitimate rights of third parties;
Conduct your professional activities without discrimination on the grounds of sex, sexual orientation, marital status, nationality, colour, race, ethnic origin, religion, age or disability, or of any other condition or requirement;
Promote equal access to the benefits of IT and seek to promote the inclusion of all sectors in society wherever opportunities arise.

Task 2 – Project Management Lifecycle and Strategy - (16 Marks)

A **software development process** is the process of dividing software development work into distinct phases to improve design, product management and project management. It is also known as a **software development life cycle**.

a) Methodologies include agile and the waterfall methodology. Choose one of these methodologies and describe it. Draw a diagram that represents all the phases in the methodology and explain the significance each phase as applied to the scenario. Specifically mention any of the participants from the scenario at each stage. Word count 500 words. (6 Marks)

Award a total of 6 marks, 3 marks for the diagram and 3 for the description of the stages in the diagram.

<u>Agile</u>

Agile software development is an approach to software development which advocates adaptive planning, evolutionary development, and continual improvement, and it encourages rapid and flexible response to change.

Agile applied to the scenario:
Initial Stage 1 – Develop functionality. The airline management and the systems analyst are the main people involved. But the maintenance crew would need to give their input as to what functions the system should have.

Output from the initial stage would be integrated into the system and tested. The systems analyst and the team of programmers would be involved here.

These two stages would be repeated until all functionality has been implemented into the system. Major players involved in these iterations would be the systems analyst and the team of programmers.

Finally when all testing has been carried out, a demo version would be released.

The airline management (the client) would give feedback and any changes required would be implemented.

A full systems test would then be carried out by the systems analyst and his team. All functionality should be present now. Also involved at this stage would be the end-users – the maintenance staff. The airline management would also be involved because this could be the final system that goes live.

If anybody is not satisfied with the system at this stage, then the whole process repeats again from the initial stage. Otherwise the system is deemed ready for deployment.

Waterfall Methodology

The output from each stage is the input to the next stage. Structured approach. Must make sure all functionality is captured during the requirements specification stage, as any changes later on are costly and time consuming.

Requirements Specification
The requirements for the software in terms of both design and functionality is captured. People involved would be the client (Airline Management), Systems analyst, Airline Maintenance Crew.

System Design
Once requirements are finalised there would be a more detailed design of the system produced using various tools (e.g Data Flow diagrams) which would be used at the implementation stage. The systems analyst would use his expertise at this stage, working with the programming team to produce a model of the proposed system

Design implementation
The model of the system produced is turned into coding by the systems analyst and the programming team.

Verification and test
The system that has been produced is tested by the systems analyst and the programming team. The Airline management would be given the results of the testing. The Airline maintenance staff would also be involved in testing. If any changes are required the whole process would have to begin again.

System Deployment
The system is set up and a pilot run is normally carried out before the system goes live. The systems analyst and the programming team would set the system up the end users (the Airline maintenance team) would be actually using the system.

Software Maintenance
Regular maintenance of the system is carried out for the lifetime of the system by the systems analyst and the programming team.

b) Assess Five (5) advantages and Five (5) disadvantages of the methodology you have chosen in part (a) if it was to be used to develop the software in the scenario.
Word count for the advantages/ disadvantages is 500 words. (10 Marks)

They can contain the following, but might have others that are just as relevant. Award a maximum of 10 marks.

<u>AGILE</u>

Advantages
Breaks product development work into small increments that minimize the amount of up-front planning and design so it is adaptive to early changes. (1 mark) In this case the systems analyst could show improvements and allow the end users more interaction with the system. (1 mark)

Each iteration involves a cross functional team. Because a working product is demonstrated by the systems analyst to the airline management it would allow some feedback as to how the system might work. (1 mark) This minimizes overall risk and allows the product to adapt to changes quickly and the systems developer could show how an interactive system could be beneficial. (1 mark)

At the end of each iteration, a review of progress is carried out and a re-evaluation of priorities with a view to ensuring alignment with customer needs and company goals, (1 mark) so any changes can be implemented early on which reduces the cost of making changes and not waiting until the whole system has been developed. In this case it would show the benefits of an interactive system (1 mark)

Disadvantages

Lack of overall product design, and the system can change dramatically within each iteration so the end-product might be quite different to what was initially proposed. (1 mark) This would not be popular with the Airline's management as they want to keep a tight control over the system (1 Mark)

Lack of sponsor support because they are not always happy with the changes taking place at each iteration, (1 mark) so the airline management might be unhappy and pull some of the funding, which will lead to failure. (1 mark)

Lack of documentation as a goal of agile software development is to focus more on producing working software and less on documentation. (1 mark) This means any changes asked for by the airline management at a later date might be difficult for the systems analyst to implement. (1 mark)

Teams are not focused because team members who appear to have spare capacity are often expected to take on other work, which makes it difficult for them to help complete the work to which their team had committed (1 mark) so the airline management might not be happy with the time it is taking to produce the end results and deadlines might not be met. (1 mark)

Waterfall Methodology

Advantages

Time spent early in the software production cycle can reduce costs at later stages. For example, a problem found in the early stages (such as requirements specification) is cheaper to fix than the same bug found later on in the process. (1 mark) So the systems analyst can stay within budget if any issues are spotted early on. This could be where they start to talk about an interactive design for the system. (1 mark)

Most medium and large projects will include a detailed set of procedures and controls, which regulate every process on the project. (1 mark). This means that the Airline's system will be carefully monitored, with the outcomes of one stage being fed into the next stage, so the team will be aware of progress. (1 mark)

It places emphasis on documentation (such as requirements documents and design documents) as well as source code. (1 mark) Any changes required by the airlines management at a later stage will be easy to implement. (1 mark)

In less thoroughly designed and documented methodologies, knowledge is lost if team members leave before the project is completed, and it may be difficult for a project to recover from the loss. (1 mark) So by using this methodology, any new members of the computing staff joining the team part way through the development can easily be a productive member of the team. (1 mark)

Disadvantages

Once an application is in the testing stage, it is very difficult to go back and change something that was not well-thought out in the concept stage. (1 mark) Because of all the issues with the fact that the system is not fully interactive, there might be changes need later on so this would make that difficult. (1 mark)

No working software is produced until late during the life cycle. (1 mark) The final system would not be available for the airline's management approval until much later on (1 mark)

Not a good model for complex and object-oriented projects. (1 mark) This is a complex system because of the health and safety features needed (1 mark).

Poor model for long and ongoing projects. (1 mark) This system would be a major system for the airline. Any ongoing issues would be difficult to deal with. (1 mark)

Task 3– RISK - (20 Marks)

All projects involve risk and it must be acknowledged.

a) Discuss FIVE (5) methods of identifying risks when developing software. Word count 100 words. (5 marks)

Award 5 marks for any 5 of the following.

How to Identify Risks:
Consult all available information/data
Customer contracts
Previous project plans
Known users
Project acceptance criteria
Functionality requirements
Technical requirements
Project team skills
Development environment
Tools, methods, hardware & software availability

b) What would you consider to be the 3 **main** risks in the Tbay Airline scenario? Please give a detailed explanation as to why you have identified these risks. Word count 500 words. (3 marks)

The answer to the second part would be a more detailed explanation of any of the above risks applied to the scenario. Any of the following can be identified as the main risks. (max 3 marks).

Functionality requirements:
The risk of not identifying the functional requirements at the outset could mean an increase in costs if the system had to be altered to add extra functionality. This would also mean that extra time would be needed to implement the extra functionality. So for example if the Airline Maintenance team identified a safety critical issue when using the system to book an aircraft in for maintenance. (1 mark)

Know Users:
If the Airline Maintenance team are not familiar with using a computerised system then they would have to trained thoroughly in it's use. (1 mark)

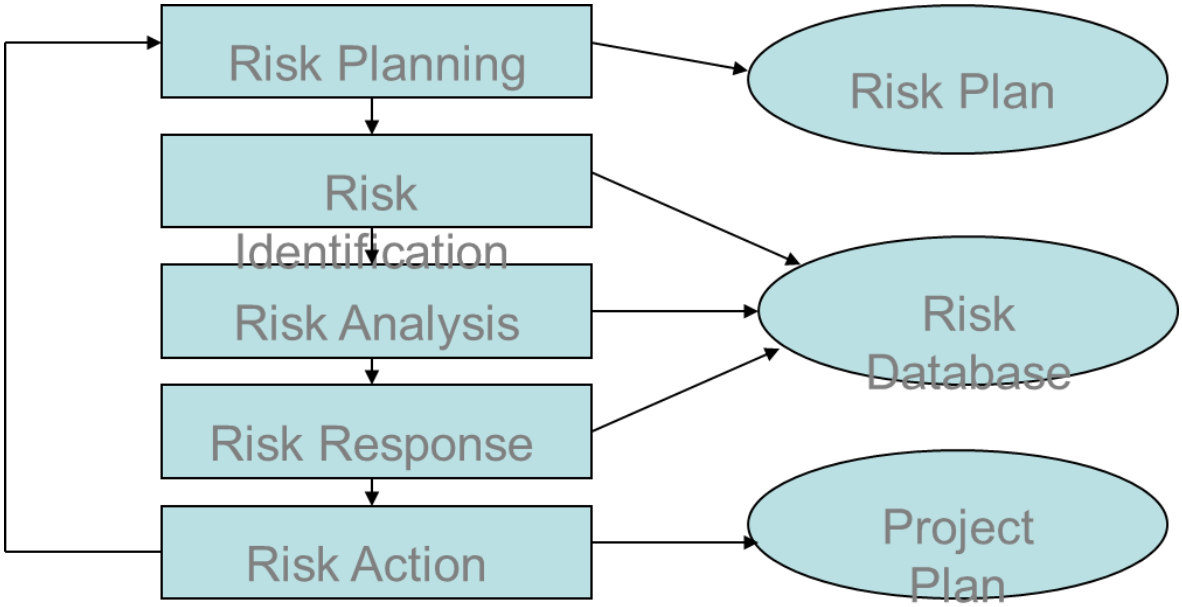
Technical Requirements:
If there has been an underestimation in the size of the finished system, the specification of the computers might not allow the new system to function efficiently. (1 mark) The system might actually need an upgraded operating system to run (1 mark).

Project team skills:
Lack of expertise. If the team working with the system analyst are not skilled enough to produce the finished system then they will need training. This should

have been identified by the system analyst when looking at the system requirements at the beginning of the project lifecycle. (1 mark) If left until the team are working on developing the software, there is a risk that the completion date will be pushed back. (1 mark)

Project Acceptance criteria:
If the project acceptance criteria have not been agreed with the client (Airline Management) from the outset then there will not be any criteria to measure the success of the system against. (1 Mark) There is a risk the Airline Management will not accept the system in its current form. This risk will cost time and money to correct. (1 Mark)

c) Risk Management should be applied to all projects. Draw a diagram that shows a simple approach to the Risk Management Process. (5 Marks)



d) Draw a Risk Assessment Map for those risks you have identified in the scenario in part b) of this question. (4 Marks).

Award 4 marks for a diagram that takes each risk identified in part b) and shows

- ***Likelihood of risk occurrence as a probability***
  - ***High*** ***>30%***
  - ***Medium*** ***10%-30%***
  - ***Low*** ***<10%***
- ***Probable scale of impact on project as a probability***
  - ***Large*** ***>30% or abandonment***
  - ***Moderate*** ***10%-30%***
  - ***Small*** ***<10%***

e) What International Standards are there for Risk Management? Choose one of these International Standards and explain their Aims and Objectives. (3 Marks) Word Count 150 words.

Award 3 marks.

- ***Few industry recognised standards for risk management exist***
- ***Three risk management standards:***
  - ***ISO 31000***
  - ***Risk Management Standard***
  - ***COSO2*** ***(1 Mark)***

e.g ISO 3100 (max 2 marks)
Aim: Provide a best practice structure for risk management
Objectives:

- ***To replace all existing standards, methodologies and approaches to risk management***
- ***To provide one generic standardisation across all industries regardless of subject area***

Task 4 – Software Deployment - (15 Marks)

Software Deployment is:
"..the process of putting software and software solutions into use or action and ultimately driving business success."

(IBM 2004:1)

a) There are many different ways of releasing software into use. Explain the different ways this can happen. (4 marks) Discuss each of these different ways to release the software in the above scenario within the airline company. Word count 300 words. (8 marks)

Award 1 mark each, maximum 4 marks, for this answer:

Pilot
Parallel
Big Bang
Web based installation

Award a maximum of 2 marks for each of the discussions of these ways. Max 8 marks.

Big Bang is a risk unless there has been extensive testing before the system goes live. We are led to believe that the airline company is worried about the cost of the system, so would they have authorised extensive testing beforehand because of the cost?

No existing companywide computerised system is in place, so Pilot is not feasible. The new system is to be installed in one area only.

Parallel: The only way to do this would be to run the new system in parallel with the existing paper-based manual system. This would not be a true comparison as the two systems are very different.

Web based installation would depend on the IT infra structure within the airline company. Is it too costly to do this?

b) Taking into account your answer to parts a) above, discuss which would be the most feasible considering the TBay Airlines scenario. 200 words. (3 marks)

Award 3 marks for a valid reason as to why they have made the choice they have given

Students will have discussed each of these different ways of releasing the new software, but now need to identify which are not feasible and which might be most suitable for the airlines system.
But the students can choose any if they support it with a valid argument. I expect they will choose Web based.

Task 5 - Service Management within the IT sector– (18 Marks)

There are two ways to approach IT Service Management. They are *in-house* and *outsourced* when looking at IT Service management (ITSM).

a) Assess THREE (3) advantages and THREE (3) disadvantages of using outsourcing for the development of the new computerised system at TBay Airlines. Word count 300 words. (6 marks)

Award max 6 marks for any 3 of the advantages and 3 of the disadvantages.

Advantages of outsourcing

- ***You can focus your energy on what matters most for your business, so TBay airlines can carry on developing other systems in-house with their existing staff.***
- ***Professionals can get work done faster because it takes less time. If TBay Airlines do not have the required level of expertise to complete a complex project themselves, then it could be outsourced to an organisation that does have the expertise.***
- ***It could save time and money because to TBay Airlines would have to go to the expense of training their staff to the required technical level to complete a project in-house.***

Disadvantages of outsourcing

- ***Once the system is deployed help is available only as needed (unless you have an ongoing contract in place). So it would be necessary for TBay Airlines to wait for a response from the company that they have outsourced to.***
- ***When you outsource, that person might not be as involved in your business, which can mean a lack of understanding on how to help. It is a risk if the airline needs immediate responses. The outsourced company might be very busy with other projects.***
- ***Working across continents can mean business hours might not line up if you're working with professionals in other locations. The users (Airline Maintenance staff) might need to speak to the outsourced company straight away, but if that company is in a location across the continent it could mean that it is the middle of the night there and no-one is available.***
- ***If you choose to out-source there is the possibility of using an outsourcing company that is not fit for purpose because they can not deliver a workable***

- ***The Airline management risk losing the intellectual property if the system is outsourced.***

b) If TBay Airlines had chosen to use in-house development. Discuss why this is seen as the best way to develop this new Airline Maintenance system. (12 marks) Word count 600 words.

Award a maximum of 12 marks for any of the reasons why.

<u>In-house development</u> should be used because if you outsource the system the company will lose the power of controlling capacities. The airline needs to keep control of their system. They own the code. (2 marks)

Developing your own software gives you the freedom to decide what features you want to include, and not include. So the airline can develop a system that exactly suits their needs. (2 marks)

You can respond rapidly to feedback (both good and bad) from the Airline Management and the end-users. (2 Marks)

The system analyst might already have some re-usable code so the coding doesn't have to start from scratch - saving time/money/effort, but still maintain that control. (2 marks)

Any system developed in-house fits exactly to the business requirements of the company. The Airline Management is aware of long and short term strategic goals. Can provide the business with a greater competitive advantage that a bought solution couldn't. (2 Marks)

There is a relationship between the development team and the users which helps in communication and expectation delivery. (1 Mark)

Allows you to differentiate from your competitors (as the system is developed for your specific needs). (1 Mark)

Task 6 – Software Quality – (16 marks)

a) There are two ways to measure software quality. Identify them and explain in more detail what they mean. (4 Marks) Which of these would be beneficial to measure the quality of the newly created TBay Airline system? (6 Marks) Where necessary please include references. Word count 400 words.

Award 2 marks each for identifying Quantitative and Qualitative.
Award a further 2 marks for the following.

Quantitative
Numeric, a 'yes/no' measure
Faults per lines of code
Program load time
Program execution time

Qualitative
Judgement based
Subjective
The interpretation of quantitative data

Award a maximum of 6 marks for the following.

A mixture of both of them could be used to measure the quality of the new TBay Airline system. Quantitative measurement is based on the actual program itself. Program load time and execution is easy to measure, as are faults per line of code. There will be standards set down in a policy that the systems analyst and the programming team would be expected to work to.
Qualitative is harder to measure as it is someone's judgement. Once again the standards set down, and the outcomes of the quantitative analysis would be used to decide on the quality of the software. The systems analyst and the programming team would be expected to work to.

b) There are many international software standards being introduced. ISO is once again the primary forerunner in software quality legislation. One of these is ISO 9126. It's Quality Model has software quality characteristics. Explain what these are and apply them to the scenario. (6 Marks) Word count 200 words.

Award 6 marks for the following.

ISO 9126
Structured software quality characteristics:

- ***Functionality***
- ***Reliability***
- ***Usability***
- ***Efficiency***
- ***Maintainability***
- ***Portability***

Each of these need to be applied to the scenario.

Submission requirements

- The word count for the word-processed report is **4000 words**.
- All references and citations must use the Harvard Style.
- You must submit a paper copy and digital copy (USB flash drive or similarly acceptable medium).

Candidate checklist

Please use the following checklist to ensure that your work is ready for submission.

Have you read the NCC Education documents *What is Academic Misconduct? Guidance for Candidates* and *Avoiding Plagiarism and Collusion: Guidance for Candidates* and ensured that you have acknowledged all the sources that you have used in your work?	❑
Have you completed the *Statement and Confirmation of Own Work* form and attached it to your assignment? **You must do this.**	❑
Have you ensured that your work has not gone over or under the recommended word count by more than 10%?	❑
Have you ensured that your work does not contain viruses and can be run directly?	❑