

# Analysis of the problem - What the examiner is looking for

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In this analysis phase you need to make sure to include all of the following sections:

## 1. Problem Identification

Start by giving a brief background to the problem. Answer the questions:

- **Describe the problem you are solving / what you will be developing**  
If you are writing a computer game, give a description of the type of game it is with a very brief explanation. Explain who will play the game and on what platform. Identify the key requirements outside the actual game play itself, e.g. in the case of a mobile phone game: easy to pick up and put down, pause at any point and continue later.
- **Describe and justify features that make problem solvable by computational methods and explain why the problem is amenable (responsive) to a computational approach**  
In Computer Science a problem can be categorised in terms of its decidability (decidable, partially decidable (may find answer or may take an infinite amount of time) and undecidable. You are looking for a decidable problem for your coursework (one which an answer can always be computed).

The key features of a computable problem are:

- The algorithm(s) must be finite in length.
- Instructions must be precise and based on a formal language.
- The algorithm will be given a set of values as input and, after a finite number of discrete steps, will produce an output.
- For any given input the correct output will always be returned.
- The algorithm must work regardless of the size of the input.
- The algorithm must halt at some point and produce correct output.
- There is no limit to the amount of space (memory) needed when calculating a solution.

You must fully justify how the solution you wish to program can be solved by computational methods. In doing so you need to ensure you get across to the examiner why the problem is responsive to a computation approach. Computational methods you have been studying for Unit 2 include:

- Thinking Abstractly & Visualisation
  - How will your problem simplify reality? If you are producing a game, simulation, training aid, booking system etc what detail **IS** important and what details from reality will you ignore or omit?
- Thinking Ahead
  - What data / inputs will be required for your solution to work?
- Thinking Procedurally & Decomposition
  - Can your problem be easily broken down and tackled in smaller chunks?
- Thinking Logically
  - Will your problem have obvious decisions points for branching or repetition (looping)?
- Thinking Concurrently

- Will there be any parts of your problem which could be solved or could happen at the same time?

Divide and conquer e.g. recursive algorithms such as quicksort is a computational method that could be relevant to some projects.

*Other computational methods, studied at A Level, that are likely to be of **no relevance** to your projects are: backtracking, data mining, heuristics, performance modelling and pipelining.*

## 2. Stakeholders

Write a paragraph to identify and describe those who have an interest in the solution (your stakeholders) and explain how the solution is appropriate to their needs. Answer the questions:

- **Who are the stakeholders?**
- **What is their interest in the solution?**
- **How will they make use of your proposed solution?**
- **Why is the solution appropriate to their needs?**

Note about stakeholders: Make sure you clearly name all of the stakeholders for your system. These must be actual named individuals that you can have regular contact with as they will be required to give you feedback and interviews throughout the development of your project. I would recommend having two named stakeholders. Decide who your game/simulation is targeted at e.g. “Teenagers into retro gaming” and then choose two named people from this target group who you will be able to have regular contact with to act as your stakeholders.

## 3. Research the problem

- **Research the problem in depth looking at existing solutions to similar problems. Identify and justify suitable approaches based on this research**

In this section you are describing the problem. With a game, take this approach to the write up:

1. Initial research: start by identifying a similar game (perhaps from the internet) and describe the mechanics of how it plays.
2. Form a set of questions to ask the stakeholders about how your game should look, sound and play. Document the stakeholders’ responses to these questions. (See note 1) E.g. Q: What does the player control in the game?  
A: The player controls a spaceship that can move left and right at the bottom of the screen.
3. Deliberate on the answers you are given and the initial research. This will inform the proposals.
4. Propose a solution to the problem by describing each element of the game in detail. You can have mock ups of the graphics from a drawing application at this stage. (See notes 2 & 3)
5. Get a response from the stakeholders about whether this meets their expectation.
6. Get an agreement from the stakeholders.

Note 1: You need to conduct an interview and/or observation of at least one existing system to know the details of what you need to know to make the program later. Keep records of the questions and observations you make, together with answers to questions.

Note 2: You need to discuss in detail exactly what the system is going to do, but not how it is

going to do it. This is not about design or algorithms, it's about the requirements. Here we are focusing on the what, not the how. Detail is very important in this section in your descriptions of the system.

Note 3: Consider a typical space invaders game. You would need to discuss that the player controls a ship. The ship can move left or right inside a fixed plane at the bottom of the screen. The ship can fire one bullet at a time. There can't be more than one bullet from the player on the screen at the same time. The objective is for the player to shoot all the invaders. The invaders start towards the top of the screen and move from left to right together in initially 5 rows of 12 invaders. When the right-most invader reaches the right edge of the screen, all the invaders move down a little on the screen and start moving from right to left. When the left-most invader reaches... etc.

'Leave no stone unturned'. Your analysis should include sufficient detail so if you were to get a programmer to read the analysis, there is nothing more they would need to ask before making the solution. Of course the really fine details may not be entirely known and will be picked up in the development process. For example, the speed at which the ship moves across the screen. You would need to play the game to know what feels right. That is unlikely to be known at the analysis stage and the necessary dialogue between you and the stakeholders will gain you marks in the design section later.

You should write your analysis as if you were having a discussion with the stakeholders. For example, "The intended audience for the game is..." "I am using my teacher as a representative for that audience." "I discussed the requirements of the game with..." "It was suggested to me that..."

Whatever the problem, it will always have a target audience and therefore identifiable stakeholders which you should be discussing requirements with and keeping records of these discussions.

- **Identify the essential features of the proposed solution explaining these choices**

In this part you should make sure to clearly explain each of the features of your proposed solution. How you choose to do this is up to you, however look carefully through your research and analysis and make sure you have not missed anything.

- **Identify and explain with justification any limitations of the proposed solution**

In this section you should also identify any limitations of your proposed solution. It will, by the nature of an A Level project be limited. If it is a game what won't it do, be realistic. This is a good time to flag up desirable features that will not be included in the solution (you can revisit this again when you write your evaluation at the end).

#### **4. Specify the proposed solution**

- **Identify and justify measureable success criteria for the proposed solution**

Project success criteria are the standards by which the project will be judged at the end to decide whether or not it has been successful in the eyes of the stakeholders.

Include the name/description of the success criteria and details about how it is going to be measured.

Avoid success criteria that cannot be measured. E.g. "It must be easy to use" is too vague.

"The user should be able to learn how to play the game through using only on-screen help." is better.

The success criteria should not be just thought up here in this section but the details relating to the success criteria should have already been identified within the “Research the problem” section. E.g. as a result of interviewing stakeholders or researching similar solutions. It would be a good idea to get feedback from the stakeholders and come up with an agreed set of success criteria.

*Initially this will be an outline set of success criteria relating to the various iterations that will be carried out during iterative development. More detailed success criteria will be added during the early stages of each iteration.*

- **Specify and justify the requirements for the solution**

Produce a table of numbered specific, measurable requirements.

Number	Requirement	Justification

Avoid requirements that cannot be measured. E.g. “A player scores points per space invader” is vague. “A player scores 50 points for each invader shot” is more specific and measurable.

The justification description will explain how you came out with that requirement e.g. you could reference a part of your research/analysis where this requirement was determined.

*Initially this will be an outline set of requirements relating to the various iterations that will be carried out during iterative development. More detailed requirements will be added during the early stages of each iteration.*

- **Specify and justify Hardware and Software configuration**

You should discuss the hardware and software required to run your program. E.g. an IBM compatible PC with x processor, y memory and z hard disk space running the Visual Basic runtime libraries? Find out the necessary spec to run the development environment i.e. VB or Access on a computer.

If any additional software is required to run your solution or if your solution is only intended to work with specific versions of software this needs to be identified here.

This section of your project write up **must** include:

SECTION	DO's		DON'Ts
1. Problem Identification	<p><b>Describe the problem you are solving / what you will be developing</b></p> <ol style="list-style-type: none"> <li>Provide an outline of what your problem is</li> </ol> <p><b>Describe and justify features that make problem solvable by computational methods and explain why the problem is amenable (responsive) to a computational approach</b></p> <ol style="list-style-type: none"> <li>Provide an explanation of features required in your computer program to provide a solution to your problem</li> <li>Explain why the problem is suited to a computer program</li> <li>Explain the features of your problem that are amenable (responsive) to a programmed solution</li> </ol>	<input type="checkbox"/>     <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>	<p><b><u>DON'TS</u></b></p> <p>Reply on simple statements of the problem Simply state that you are going to create a program because it is needed. You must justify decisions</p>
2. Stakeholders	<ol style="list-style-type: none"> <li>Identify two or more stakeholders.</li> <li>Explain how the proposed solution is appropriate to their needs. (Explain why the output from the solution is valuable to the stakeholders)</li> <li>Keep returning to the stakeholders for input throughout the project</li> </ol>	<input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>	<p><b><u>DON'TS</u></b></p> <p>Identify stakeholders who cannot be easily contacted throughout the project</p>
3. Research the problem	<p><b>Research the problem in depth looking at existing solutions to similar problems. Identify and justify suitable approaches based on this research</b></p> <ol style="list-style-type: none"> <li>Provide detailed research into existing solutions to similar problems</li> <li>Show that the research identifies features that can be adapted for use in your proposed solution.</li> <li>Show how the research provides insight into the proposed solution and how the features to be used are appropriate</li> </ol>	<input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>	<p><b><u>DON'TS</u></b></p> <p>Rely on your own input for the solution to your problem</p> <p>Rely on an interview with the stakeholders for all your research into the problem</p> <p>Attempt to solve to solve problems that are too complex in the time allowed</p>

