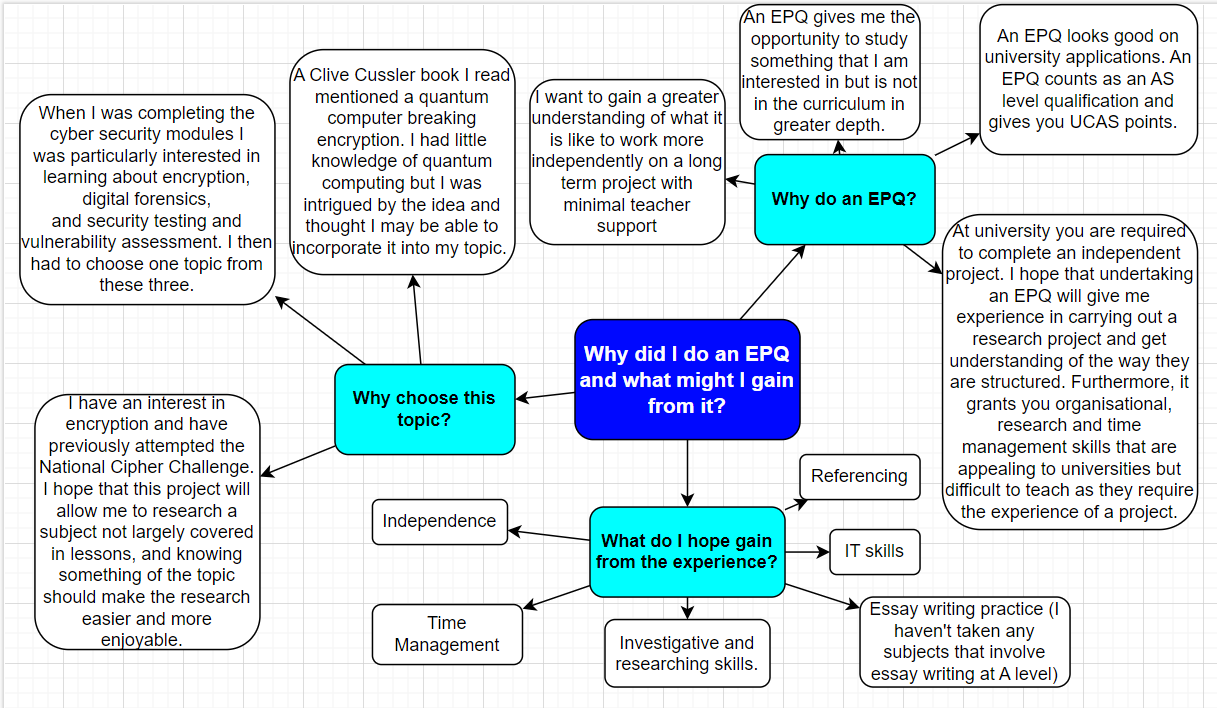
# Mind Map



# Gantt Chart

A graph with orange squares

Description automatically generated with medium confidence

# Timeline

|  |  |  |  |
| --- | --- | --- | --- |
| Task | Suggested start date (bold dates are deadlines not suggested dates) | Details | Date completed |
| Research my topics – encryption and quantum computing. | 6/2/23 | I should start reading books and looking at articles on the subject as soon as possible to give me a grounding knowledge and help me find sources later on. | 14/2/23 |
| Plan the introduction to my essay. | 3/3/23 | Plan out how I will introduce the topic (introductory quote?), any terms and concepts I may want to initially explain, and perhaps cover why quantum computing is so important and relevant. | 6/3/23 |
| Plan the layout of section 1 (history of encryption) | 13/3/23 | Plan out each paragraph – possibly each will be on a different form of encryption, and split encryption into eras based on its evolution. | 13/3/23 |
| Acquire quotes for section 1 (history of encryption) | 30/3/23 | Go through my books on encryption, google and google scholar looking for quotes and research papers on encryption. | 8/4/23 |
| Plan the layout of section 2 (quantum mechanics and quantum computing) | 10/4/23 | Plan out what quantum effects will be discussed. Plan out a description of how quantum computers work – make sure to include quantum effects that are relevant to quantum computing. | 22/4/23 |
| Acquire quotes for section 2 (quantum mechanics and quantum computing) | 30/4/23 | Go through my books on quantum mechanics and computing, google and google scholar looking for quotes and relevant research papers. | 8/5/23 |
| Plan the layout of section 3 (quantum computing – threat and mitigation) | 15/5/23 | What sort of codes can quantum computers break quickly? What algorithms do they use? Include the different types of defence and their advantages and disadvantages. | 30/5/23 |
| Acquire quotes for section 3 (quantum computing – threat and mitigation) | 10/6/23 | Go through my books on quantum computing, google and google scholar looking for quotes and research papers on the threat quantum computing poses and how to mitigate it. | 22/6/23 |
| **Submit planning review** | **26/6/23** | **N/A** | **26/6/23** |
| Begin writing the introduction and section 1 (history of encryption) | 29/6/23 | I will use my plan to write my introduction and section one. I may write a draft, then improve it. For the introduction, I will lay out what is in the essay and why, possibly explaining key concepts – but I must avoid tangents. For section one, my plan will have it into a few sections, each with a number of bullet points that should be a paragraph each. Not every bullet point however may be included due to the word limit, as some are more relevant/important than others. | 1/8/23 |
| Begin writing section 2 (quantum mechanics and quantum computing) | 1/8/23 | I will convert my plan for section 2 into an essay. Possibly write a draft, then improve it. My plan will have split section 2 into a couple of sections, each with a number of bullet points that should be a paragraph each. | 25/8/23 |
| Start writing section 3 (quantum computing – threat and mitigation) and conclusion | 1/9/23 | I will convert my plan for section 3 into an essay. Possibly write a draft, then improve it. My plan will have split section 3 into a couple of sections, each with a number of bullet points that should be a paragraph each. I will then write a conclusion that will sum up my essay and answer the title question. | 24/9/23 |
| **Submit mid-project review** | **15/9/23** | **N/A** | **15/9/23** |
| Finish writing section 3 and conclusion. Ensure glossary, bibliography and references are fully complete. | 15/9/23 | Make sure my references are formatted correctly and that my bibliography and reference lists are complete. I also need to check through my essay to ensure that any unexplained key terms and concepts are in the glossary. | 24/9/23 |
| Start writing the presentation | 25/9/23 | I will create a visual outline for the presentation. Write introductory slides and slides on planning, research and the sections of my essay, as well as the evaluation/reflection/summary. Include thanks for listening and any questions slides. | 17/10/23 |
| Start writing end-project review, summary and reflection | 1/10/23 | Evaluate how successful my time doing an EPQ has been and what skills I have gained throughout the journey. | 5/10/23 |
| **Submit end-project review, summary and reflection** | **9/10/23** | **N/A** | **9/10/23** |
| **Presentation** | **30/10/23** | **Give my presentation in front of my supervisor and possibly classmates – this may be recorded.** | 30/10/23 |
| **Final Submission** | **13/11/23** | **Submit all work including my EPQ essay, my work log and my modules log.** | **13/11/13** |

# Work Log

|  |  |  |  |
| --- | --- | --- | --- |
| Date | Work done | Skills gained | Evaluation |
| 5/2/23 | I have completed all of the cyber security modules and submitted the log. | I have gained a great deal of knowledge in the field of cyber security. Completing the course required a considerable amount of independent work and needed self-motivation and time management skills to complete it within the time frame. | I have completed all the modules and submitted the log successfully. I was particularly interested in learning about encryption, digital forensics, and security testing and vulnerability assessment. I found the materials provided easy to follow. Having videos to break up the text helped me to focus and made my note-taking more efficient as I could watch and type at the same time. |
| 6/2/23 | I have created a Gantt chart | ICT skills were used to learn how to create and fill the Gantt chart. | I tried a few different templates to create the chart but found they were too complicated as they were aimed at businesses. I then found a youtube video which taught me how to create the chart in a simple but effective way. I am pleased with the results. |
| 8/2/23 - 14/2/23 | I have undertaken preliminary research into the topics of greatest interest. | I have been reading more about encryption, digital forensics and pen testing. This has required some research skills such as searching for, locating and evaluating information. | I have looked at a range of websites, articles and books. From this information I have decided I am most interested in encryption. My research has led me to realise the impact quantum computing could have on cryptography and this is something I would like to further research. |
| 15/2/23 | I have completed and submitted my record of initial planning suggesting my topic will be how quantum computing will impact cryptography. | Decision making skills were required to narrow down exactly what I wanted to research. Research skills were used to look further into the subject and ensure it was the correct choice for me. Communication skills were used to discuss the title options. | My supervisor felt that the topic was possible and was not too small or large. He agreed with my preferred choice of title from the different options. I had to order some books on line as there was nothing relevant available in the school library. I was somewhat limited by price and some of the books were more technical than I had anticipated however I hopefully have a good range. |
| 20/2/23 | I decided on a title for my essay: How has encryption evolved and what does the future hold for it in the age of quantum computing? | Decision making skills were required to choose an effective title.  I learned the importance of not being too vague and realised my title needed to be clear and concise. | I contemplated several different titles before making my decision. Some were too ambiguous. I had considered “What does the future hold for encryption in the age of quantum computing?” but felt this may not give me enough scope. I wanted a title that allowed me to do more than speculate about the future – to look at the past as well. |
| 24/2/23 | I had a session with my supervisor setting up a OneDrive document for the EPQ. | I learnt a number of ICT skills: setting up documents in OneDrive, adding a title page and adding a table of contents. | I have created a document that can be accessed from home and school so I can more easily access my work when I am not at school. I have completed a title page and table of contents and found the process very intuitive. I will be able to use these skills in any further essays or projects and also in my NEA. |
| 25/2/23 | Completed my project proposal with my choice of title. | Planning and organisational skills such as goal setting to decide on my next steps. | Both my supervisor and the centre coordinator were satisfied with my project proposal and I am feeling prepared and confident. |
| 29/2/23 | I have decided how to structure my essay. | Planning skills to create the optimal layout for my essay, ensuring I cover all the key areas. | I am going to split my essay into 3 main sections – a history of encryption, quantum mechanics and quantum computing and the threat quantum computing poses and how it can be mitigated. I feel like this is a substantial project and there is a great deal that could be covered. |
| 31/2/23 | I had a session with my supervisor on how to reference in a word document. | ICT skills:  Referencing – I now know how to automatically reference in a word document. | I have been shown how to reference automatically in a word document and created a sample reference. This will be a useful skill for this project, in my NEA and also at University. |
| 3-6/3/23 | I have planned my introduction. | Planning and organisation skills were required to decide how to structure my introduction to ensure I gave an effective summary of the project. | I felt that the most important points for my introduction to cover were an overview of the topic and the key terms to give the reader context. I am still debating whether to put some of the terms into a glossary. |
| 7-13/3/23 | I have planned section one of my essay - The history of encryption. | Planning and organisation skills were required to decide how to structure section one to ensure I gave a comprehensive account of encryption through time. | Section one is going to focus on the history of cryptography, with a large amount of fact on how forms of encryption have changed over time. I have decided to talk about this as seeing how encryption has evolved in the past may be relevant to how it will evolve in the future when quantum computing becomes a reality. I want to prevent this section from becoming a list of codes and instead focus on the evolution and improvements to keep this part relevant and interesting. I’ve gathered as much information as possible to show that this section is well researched and to hopefully ensure I am aware of all the key developments even if much of the research will not be able to be incorporated into the final write-up due to the limited word count. |
| 16/3/23 | I had a session with my supervisor focusing on research. | I have improved my ICT research skills, especially pertaining to google scholar. For example, using key words rather than full sentences, using quotes to look for an exact matches and using Boolean operators. Also using analytical skills to assess sources to ensure they are reliable and accurate. | The supervisor showed us how to use google scholar to find research papers and other higher quality sources. I expect now that I am using this tool will make it quicker and easier to find relevant and reliable information. These skills will be useful in not only this project but in any future projects I may undertake.  I have found however that many journal articles are behind a paywall so I am still somewhat limited as to what I can access. |
| 1/4/23 - 8/4/23 | I gathered possible quotes for section one of my essay. | I have discarded some sources as biased or inaccurate. This has improved my critical thinking and data analysis skills. | I had a number of quotes marked in the books I had read. I thought it would be useful to have a bank of relevant and interesting quotes taken from these books as well as the other sources I had found.  Using google scholar I have been able to find more reliable and detailed sources. |
| 10 - 22/4/23 | I have planned section two of my essay – quantum mechanics and quantum computing. | Planning and organisation skills were required to decide how to structure section two, to allow me to explain the parts of quantum mechanics that are relevant to quantum computing. Communication skills were necessary to try to explain complex phenomena in the most accessible way. | I realised the complexity of quantum mechanics during my research and planning. I have come to the conclusion that it is important to find a way to make this topic as accessible as possible for people without a scientific background.  As some of the principles behind quantum mechanics are so difficult to understand, I am only going to include those that pertain to quantum computing. |
| 27/4/23 - 8/5/23 | I have gathered quotes for section two of my essay. | I have improved my researching skills and my analytical skills at judging the accuracy and credibility of sources. | Using my books and google scholar to find articles and research papers I have found many quotes that I feel may be useful when writing this section. |
| 15-30/5/23 | I planned section three of my essay – quantum computing: threats and mitigation. | Planning and organisation skills were required to decide how to structure section three. | I have decided to split this section into the threat quantum computers pose, specifically discussing Shor’s and Grover’s algorithms, and how we can defend against quantum computing looking at quantum key distribution and quantum-proof classical encryption. I feel that this covers the main threats from and defences against quantum computers. |
| 10-22/6/23 | I have gathered quotes for section three of my essay. | I have improved my researching skills and my analytical skills at judging the accuracy and credibility of sources. | Using my books and google scholar to find articles and research papers I have found many quotes that I feel may be useful when writing this section. |
| 25/6/23 | I have completed the planning review. | Time management to ensure the plan was completed by the deadline. | My supervisor felt I could include more detail on my sources, especially their reliability but was otherwise satisfied. I have decided to compile a table of my sources assessing each one in more detail. |
| 27/6/23 - 15/7/23 | I have written the introduction and section one of my essay. | I have further researched what should be included in the introduction of a research paper to improve my writing skills. As a result I have decided to include some additional information. | I have extended the introduction to include my aims and what I hope to accomplish as I have found that these points are typical of an introduction to a research paper and that they are necessary to make my intentions clear to the reader.  It was important to me that section one didn’t merely become a long list of names and dates, I wanted to show how and why it evolved.  My conclusion about section one is that it is too long and not formal enough for a research essay. Therefore I have decided to use it as a draft and rewrite it. I also feel that the quotes do not flow as smoothly as I would like. |
| 16/7/23-1/8/23 | I have rewritten section one of my essay. | I have learnt the importance of being succinct and staying within the word count. Decision making skills were required to decide what to keep in and what to take out the section. I have improved my writing skills by integrating quotes into the essay in a way that allows it to flow more smoothly. | I have rewritten my section one draft to be more formal.  I hadn’t realised how difficult it would be to considerably reduce the word count after writing the section. Deciding what to take out was challenging and surprisingly time consuming. In the future I will be far more careful to ensure I constantly monitor the length of my essay and try to avoid exceeding the number of words allocated. |
| 2- 25/8/23 | I have written section 2 of my essay. | In this section, I have had the difficulty of explaining quantum mechanics in such a way that it can be understood while simultaneously being concise. It is difficult to explain such a vast and complex topic within the word count and so I have developed my writing skills. | In this section I have been more successful in my attempt to keep within the word limit. It is still a little longer than I would like as I have found it difficult to explain the complex phenomena in such a limited number of words. This is something I will continue to work on in section three. I have decided to include a paragraph on quantum interference as this is another part of quantum mechanics that is relevant to quantum computing. However I have decided to exclude the many universes theory as it hasn’t been proven, isn’t relevant to quantum computing and may just confuse people. I also decided to leave out the problems that quantum computers will not be able to solve such as non-Turing complete problems, and problems that require a more than exponential speedup to be tractable. I want to concentrate more on what quantum computers are able to do as breaking encryption will be a possibility.  I have been finding it difficult to locate specific quotes in my large plan document. In future projects I would have a separate document containing a table of quotes. |
| 2/9/23 | I am considering changing my title to “How has encryption evolved and can it survive in the age of quantum computing?”  Do I need an abstract? | Decision making skills to decide that I needed to change my title. | I am going to ask my supervisor to allow me to change my title at the mid-project review. While this seems like a big change at this late stage, my current title is rather open-ended, instead of having two sides that I can discuss (whether or not encryption will survive). This will make writing section three and my conclusion much easier. I also need to find out if an abstract is necessary, and if so if this contributes to the word count as I am struggling to keep my essay within the word count already, so it is better to know sooner rather than later. |
| 12/9/23 | I have completed my mid-project review. | Communication skills to discuss the issues. | I have completed my review and I am pleased with how my project is progressing. I have documented some changes I made to my introduction as I needed to include my aims and objectives. My supervisor agreed that changing my title was a good idea which I am glad about and doesn’t affect the parts of the essay that I have already written. |
| 3-24/9/23 | I have written section 3 of my essay and my conclusion, as well as completing the glossary. | I have been improving my writing skills by ensuring I am being succinct and keeping within my word limit. | I found writing this section much more enjoyable and easier, as I have learned from previous sections about keeping within the word count and being succinct, but still getting across everything I need to. This was the simplest to write as I do not have to compress an entire history, or explain very confusing concepts. I am also satisfied with my conclusion as I feel it addresses each of my sections and also my (revised) title. I found my glossary to be very useful when I was trying to keep within the word count, as it meant I did not have to explain complex terms in my essay, which used up a lot of words without really contributing anything. |
| 25/9/23-4/10/23 | I have spoken to my supervisor regarding referencing and have now completed my references and bibliography. I have also completed my end project review. | I have been improving my referencing skills by reading up on the different referencing systems. I have also learnt that it is possible to have references and a bibliography. | I have been looking into different referencing systems, like Harvard and Chicago to learn how each works and their differences. I have checked in with my supervisor and he has said we can use any referencing system as long as we are consistent. I am going to use the IEEE referencing system because this is the example system we were shown by our supervisor, it is also the system used in computer science by the university I hope to attend and it also helps to keep my word count down as only a number is required at the end of a quote rather than a name and date. I wrote a reference list but then realised that this meant a large number of sources that I had read but did not quote would be excluded. I then wondered if I should do a bibliography instead but didn’t know how this would be compatible with my referencing system. I spoke to my supervisor and he said it was possible to do both a reference list and a bibliography and so I decided that would be the best approach. I have reflected on this in my end project review. |
| 5-17/10/23 | Created my presentation. | IT skills to create the  PowerPoint presentation | I have now completed my PowerPoint presentation. I watched some tutorials on Youtube and learnt how to use the Designer feature and some new transitions. I have also written some notes to go with each slide to prompt me, but I still need to rehearse my delivery in preparation for the day. |
| 30/10/23 | Carried out my presentation. | Communication skills to share my project with my class and Supervisor. | Overall I felt my presentation was quite successful - I was well prepared and had rehearsed it several times. I had had to cut down the length of it as initially it was over 30 minutes long. At first this wasn’t too difficult as I took out a few parts that I didn’t think were as important but I realised I wasn’t really going to have much time to talk around each topic . Because I’m autistic I don’t find giving presentations easy - I get anxious when talking in front of groups of people and am not great with eye contact. I didn’t feel too stressed giving my presentation and although I had been quite worried about what questions I might be asked I didn’t find them too difficult. I was a little caught off guard by a question on teleportation but I quickly managed to come up with an answer. |
| 31/10/23 – 5/11/23 | I have written my project summary and reflection. | Analytical skills to evaluate how my project has progressed. | I enjoyed reflecting on the progress I had made and the things I had learnt whilst doing my EPQ. I am really pleased that I have manged to complete my EPQ and feel it has been very successful. |