



TUXFORD  
— ACADEMY —

# Post 16 Preparation

Bridging Unit













## Computer Science

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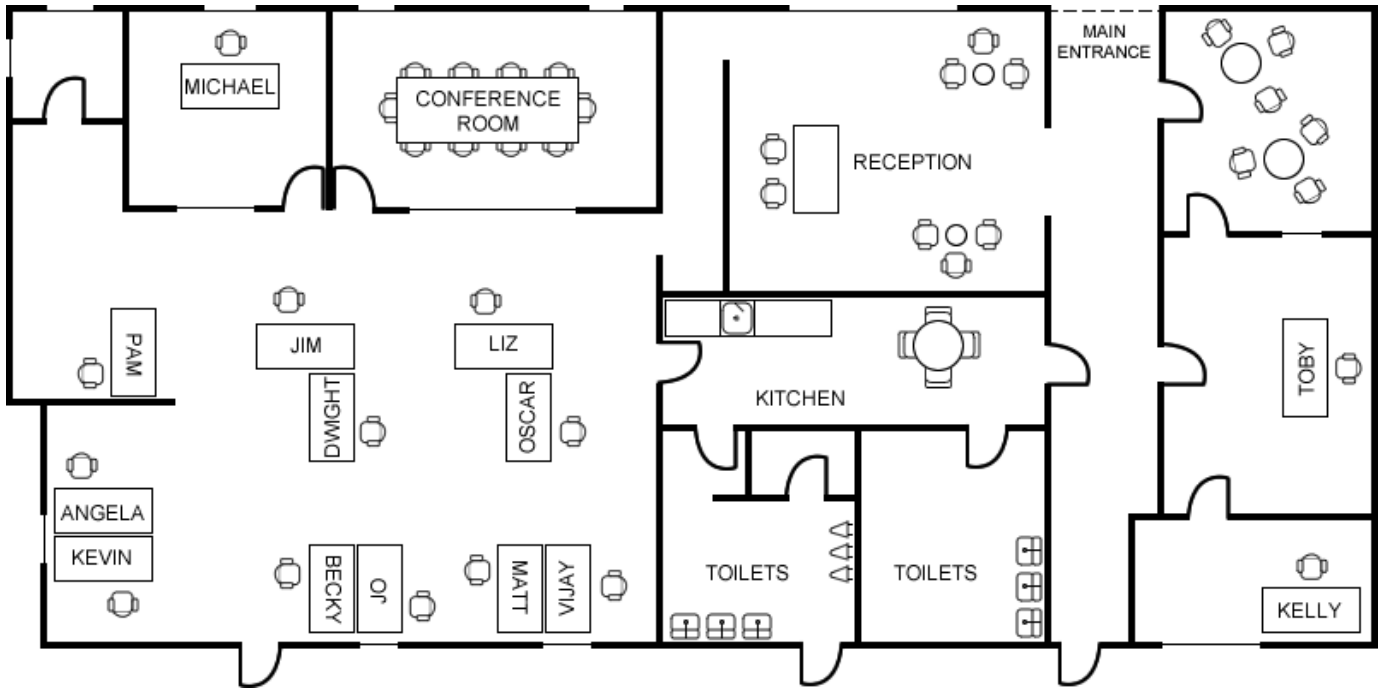
We empower | We respect | We care

Part of  Diverse  
Academies

## Listen Watch Learn

 <p><b>Watch</b> this talk from a successful start-up founder, where he explains the surprising result of his research.</p> <p><a href="#">The single biggest reason why start-ups succeed</a> <i>TED Talk – Bill Gross</i></p>	 <p><b>Complete</b> this course which explores how the way we work will change in a world of automation.</p> <p><a href="#">The future of work - preparing for disruption</a> <i>Open Learning Campus</i></p>	 <p><b>Read</b> this article about the future of teaching in the world of AI.</p> <p><a href="#">Intelligent machines will replace teachers in ten years</a> The Independent</p>
 <p><b>Listen</b> to this radio interview with software pioneer Dame Stephanie Shirley.</p> <p><a href="#">Life Scientific</a> <i>BBC Sounds</i></p>	 <p><b>Watch</b> this tv series which explores how advances in A.I will change our outlook on many fields.</p> <p><a href="#">The Age of A.I</a> <i>Youtube Originals</i></p>	 <p><b>Complete</b> this course which explores the evolution of cryptography and how we use it in modern computing.</p> <p><a href="#">Journey into Cryptography</a> <i>Khan Academy</i></p>
 <p><b>Read</b> this article about how a cybersecurity attack threatened to destroy the 2018 Olympics.</p> <p><a href="#">The Untold Story of the 2018 Olympics Cyberattack</a> <i>Wired Magazine</i></p>	 <p><b>Listen</b> to this radio programme which explores whether computers can beat humans at games.</p> <p><a href="#">Seriously...Game over humans</a> <i>BBC Sounds</i></p>	 <p><b>Watch</b> this talk from the creator of Wolfram Alpha about his quest to make all knowledge computational.</p> <p><a href="#">Computing a Theory of All Knowledge</a> <i>TED Talk – Steve Wolfram</i></p>
 <p><b>Listen</b> to this radio interview about whether algorithms can be relied upon to do the right thing.</p> <p><a href="#">Algorithm Overloads</a> <i>BBC Sounds</i></p>	 <p><b>Watch</b> this talk about the backbone of the modern Internet</p> <p><a href="#">The Hidden Network that Makes The Internet Possible</a> <i>TEDEd – Sajan Saini</i></p>	 <p><b>Complete</b> this course which explores the history of communication.</p> <p><a href="#">Journey into information Theory</a> <i>Khan Academy</i></p>

# Networks

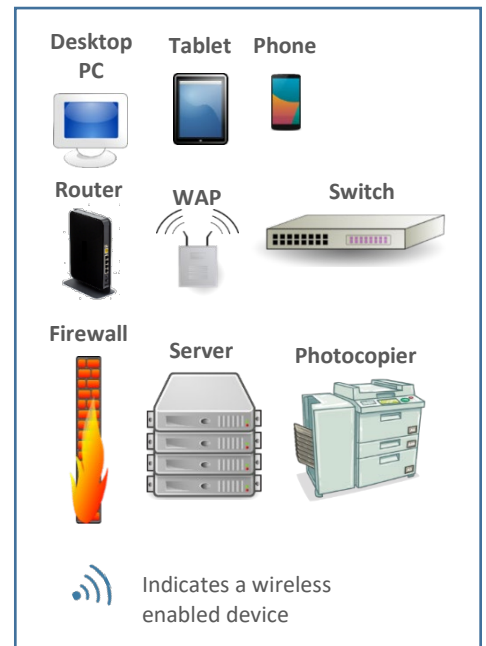


Carry out some research on computer networks, in particular LANs, WiFi, Network topologies and connectivity devices.

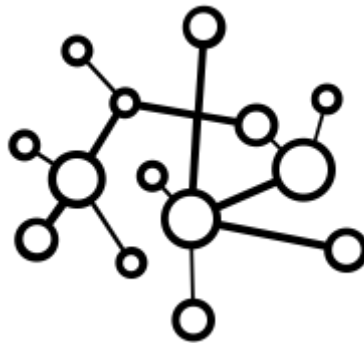
Use the symbols on the right (feel free to revise them) to create an appropriate network over the floorplan above.

Make sure your network meets all the following requirements:

1. Each member of the main office needs a desktop PC
2. Angela, Pam, Dwight and Oscar also use an office issued smart phone
3. The following rooms new access to WiFi:
  1. Meeting room (top right)
  2. Reception
  3. Conference Room
  4. Main office
4. Use a circle with a transparent fill (so you can see the network underneath) with a width and height of 12.5cm to provide the WiFi coverage needed to cover the rooms above:
  1. The circles need to have a WAP at the centre
  2. The 12.5cm diameter circles represent the maximum range of each WAP



3. They WAP icons must be attached to a wall
4. You must use the minimum number of WAP possible to provide the coverage needed
5. All desktop PCs use wired connections in a star network configuration
  1. The top left server room, conference room and main office need to be on one subnet with its own switch
  2. All other rooms are on a separate subnet and will require its own hardware for this
  3. The two subnets need to be appropriately connected together
6. The top left room needs to have a server placed in it and connected appropriately to the local subnet
7. The server room needs hardware to appropriately connected the LAN to "The Internet"
8. Reception needs a photocopier and it needs connecting to the local subnet
9. A firewall should be placed somewhere appropriate



## Independent Research

Keeping up to date with advances in technology and computing is not always easy as new developments are reported daily. As an A Level student you will be asked to keep up to date with technology related news as part of your wider reading around the subject. Learning to choose your sources widely is also an important skill, relying on Wikipedia isn't going to cut it! Reference any sources that you use to help you.

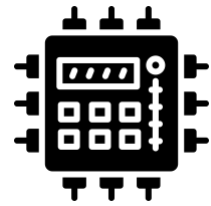


1. Compare the Xbox ONE, PS4 Pro and PC as gaming platforms. You must use as much technical detail as possible and reference any evidence presented. Choose how you will present your ideas.
2. Find a recent news story on one of the following topics – the website and blogs links later in this document may help:
  - A legal issue in computing, such as a breach of the Data Protection Act
  - An ethical issue in computing, such as the development of AI
  - An environmental issue in computing, such as the disposal of waste equipment
  - A technical development in computer science, such as the Internet of Things

Summarise the story, explaining any technical content for a student in year 10.  
Explain how the story affects you as a student of computer science.

## Emerging Computer Technology

All new technology comes with benefits and potential drawbacks and we are still learning just how technology such as machine learning and AI will impact on us. This can lead to a range of **Social, Moral, Cultural** and **Ethical** issues. A key A Level skill is being able to look at both sides of the argument and draw logical conclusions based on the evidence. In this task you get to investigate any area of emerging computer technology which interests you.



You can pick any area which interests you, but examples could be:

- Artificial intelligence
- Robotics
- Automated self-driving cars
- Quantum computing

In no more than ONE side of A4 summarise the area you have chosen under the following four headings:

1. What is it?
2. What are the possible Social, Moral, Cultural and Ethical **benefits** of this technology on society
3. What are the possible Social, Moral, Cultural and Ethical **risks** of this technology on society
4. My conclusion on this technology and what it will mean for our world 10 years from now



# Augmented Reality



A key skill at A Level is being able to take a topic and then discuss it in the context of different scenarios.

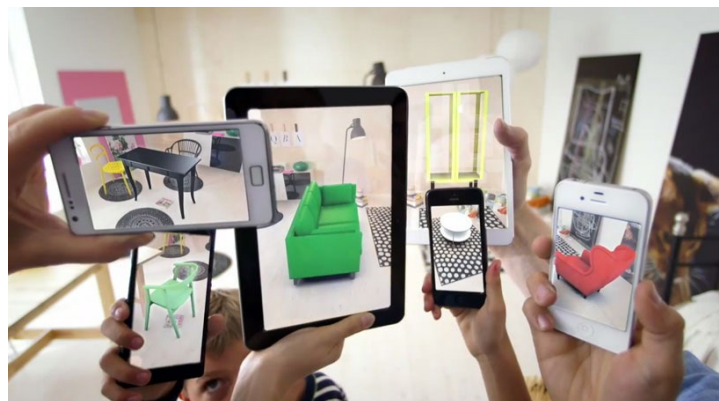
Most theory-based exam questions will be asked in the form of a scenario, simply regurgitating what you know on the topic without contextualising your answer to the scenario will often result in low marks!

The topic for this exercise is “Augmented Reality”. It is a truly fascinating area of technology which has the potential to change almost every aspect of our daily lives.

Watch this brief video to learn more: <https://www.youtube.com/watch?v=vQtwWzfKXI>

After watching the video, discuss the benefits, limitations and risks of augmented reality in the context of:

- Medicine & health care
- Gaming & entertainment
- Schools & learning
- Travel & tourism
- Social media
- Transport & navigation



## Problem Solving Skills

At GCSE you will have learned skills such as decomposition and abstraction. Problem solving and algorithmic thinking skills are vital. Have a go at these puzzles:



### A deduction puzzle

There are four programmers, each of whom codes in a different language and has their own reason for studying computer science. Can you use the clues provided to match each programmer to the correct programming language and motivation for studying computer science?

1. Of the one who likes puzzles and the one who loves maths, one is Alice and the other programs in C.
2. The python programmer's name is alphabetically one more than the person who enjoys solving puzzles
3. Bob got into computer science through gaming
4. Of Dave and Bob, one wants to study computer science for the money, while the other codes in VB

### Knights, Knaves and Spies

On the fabled Island of Knights and Knaves, we meet three people, A, B, and C, one of whom is a knight, one a knave, and one a spy. The knight always tells the truth, the knave always lies, and the spy can either lie or tell the truth.

A says: "C is a knave."

B says: "A is a knight."

C says: "I am the spy."

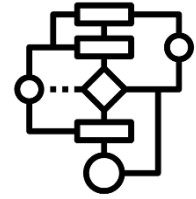
*Who is the knight, who the knave and who the spy?*





## Algorithmic Thinking

Each of the following puzzles requires you to design an algorithm. You may want to start by writing out some examples to help you understand the problem.



## Weighing and measuring

1. You have 10 bags of coins, each bag contains 100 coins. Nine of the bags contain real coins; each real coin weighs 1 gram. One bag contains fake coins; each fake coin weighs 0.9 grams.

If you have an accurate scale that will display the weight of an object placed on it, how can you identify the bag of forgeries using the scale only once?

2. You have 12 coins, one of which is fake. The fake is either lighter or heavier than the real coins, but you do not know which. You have a balance that you can use to compare the weights of items.

How can you find the fake coin in just three uses of the balance? (You have no other weights or reference objects, just the balance and 12 coins.)

## Light switches

This puzzle was an Oxford University interview question.

You are standing in a room with three light switches. Each switch controls exactly one light bulb in the next room. (This is a budget puzzle, so they are plain, cheap, basic light bulbs.) The door to the next room is closed, and there are no windows, so you cannot see the light bulbs. You may manipulate the switches as much as you like, then you may go through into the room with the lights. You must then say which switch controls which bulb. How do you do it?



## Programming Practice

As part of your A Level course you will undertake a significant project and you will need to ensure that your programming skills are sufficient to allow this. You may choose to continue with Python or can chose another language such as C# or C++ and use a platform such as [Unity](#), [GoDot](#) or [Defold](#). The following courses and challenges will help you to prepare for A Level programming problems.



### **Programming 102: Think Like a Computer Scientist** - [Future Learn - Programming 102 - Think Like a Computer Scientist](#)

Learn how to break down problems into smaller parts, and then design and apply algorithms to data. This course will teach you how to use functions with parameters and return values, how to use list structures and efficient searching and sorting algorithms.

### **Object-oriented Programming in Python** – [Future Learning Object Orientated Python](#)

Learn object-oriented programming principles by creating your own text-based adventure game in Python. This course will ensure you understand the difference between a function and an object, teach you how to create objects, functions, methods, and classes in Python and how to extend classes using inheritance and polymorphism.

### **Project Euler** - <https://projecteuler.net/>

Project Euler is a series of challenging mathematical/computer programming problems that will require more than just mathematical insights to solve. Although mathematics will help you arrive at elegant and efficient methods, the use of a computer and programming skills will be required to solve most problems.

### **British Informatics Olympiad** <https://www.olympiad.org.uk/problems.html>

The British Informatics Olympiad (BIO) is an annual computer-programming competition for secondary and sixth-form students. Previous problems can be accessed at the link above and cover a range of difficulties.

## Wider Reading

### Books



As part of your A-Level studies, and if you plan to go on to further study you will need to develop a wide understanding of Computer Science and how it impacts our lives. These books are a great place to start.

<i>Once Upon an Algorithm: How Stories Explain Computing</i>	Erwin, Martin	978-0262036634
<i>Computational Fairy Tales</i>	Kubica, Jeremy	978-1477550298
<i>Lauren Ipsum: A Story About Computer Science and Other Improbable Things</i>	Bueno, Carlos	978-1593275747
<i>Nine Algorithms That Changed the Future: The Ingenious Ideas That Drive Today's Computers</i>	MacCormack, John	978-0691147147
<i>Algorithms to Live By: The Computer Science of Human Decisions</i>	Christian, Brian	978-0007547999
<i>In Pursuit of the Traveling Salesman: Mathematics at the Limits of Computation</i>	Cook, William	978-0691152707
<i>Brown Dogs and Barbers: What's Computer Science All About?</i>	Beecher, Karl	978-3000470578
<i>Hello World: How to be Human in the Age of the Machine</i>	Fry, Hannah	978-1784163068
<i>Chaos Monkeys: Inside the Silicon Valley Money Machine</i>	Martinez, Antonio Garcia	978-1785034558
<i>The Future Is Faster Than You Think: How Converging Technologies Are Transforming Business, Industries, and Our Lives</i>	Diamandis, Peter & Kotler, Steven	978-1982109660
<i>Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy</i>	O'Neil, Cathy	978-0141985411

### Websites/Blogs



The Guardian Technology Pages - <https://www.theguardian.com/uk/technology>

The Register - <https://www.theregister.co.uk/>

Wired magazine - <https://www.wired.co.uk/>

ARS Technica - <https://arstechnica.com/>

BBC Click - <https://www.bbc.co.uk/programmes/b006m9ry>