Subject: Computer Science Pre-A-level Transition Work

Introduction

The aim of this document is to help you ease into the OCR A-level Computer Science course.

Course Structure

OCR Computer Science H446 - Specification

This is a two-year, linear A-level course which will be formally assessed at the end of the two years. The content of this A-level in Computer Science is divided into three components:

- **Computer systems component (01)** contains the majority of the content of the specification and is assessed in a written paper recalling knowledge and understanding.
- **Algorithms and programming component (02)** relates principally to problem solving skills needed by learners to apply the knowledge and understanding encountered in Component 01.
- **Programming project component (03)** is a practical portfolio-based assessment with a task that is chosen by you and is produced in an appropriate programming language of your choice.

Recommended reading

The following are some texts to help you with your course:

- **OCR AS and A Level Computer Science** *PM Heathcote & RSU Heathcote* (Available on Amazon)
- **Tackling A Level projects in Computer Science OCR H446** *Ceredig Cattanach-Chell* (Available on Amazon)
- **The British Informatics Olympiad** Available at https://www.olympiad.org.uk/problems.html

Transition Activities

Activity 1 – Binary Truth Tables

1. Complete the truth tables below.

NOT (A AND B)

((NOT A) OR (NOT B))

2. What do you notice about these tables?

3. Stretch activity – Read on Half and Full Adder Circuit

https://www.electronics-tutorials.ws/combination/comb_7.html

Activity 2 - Research essay

You are required to research and write an essay (of minimum 250 words) **on one of the following topics**. You may use the Internet based resources but the wording must be yours.

1. Programming languages: what are the five most popular programming languages? What are their strengths and weaknesses? Compare their application in business and finance industry, gaming technologies and science and engineering.
2. Gaming technologies: review the history and evolution of gaming technologies from the console to the cloud. Compare the languages and technologies (*eg*. AI) that may be used in the games and comment on the pros and cons of each technology using examples.
3. Artificial Intelligence and Robotics: review the history of robotics and their evolution. Discuss the role and impact of AI and robotics in workplace and employment. Comment on advantages and disadvantage of robotics to humans. How do you see the future of A.I. in the light of Stephen Hawking's recent observation: 'AI could end mankind.'

Activity 3 – Solving a puzzle

The Princess in the Castle: Originally heard on Puzzle Panel on BBC Radio 4.

A princess lives in a long corridor in a castle. The corridor has 17 rooms, numbered 1 to 17 inclusive. Each night the princess sleeps in a different room according to the following rules:

- On the first night of the year she sleeps in a random room
- Each night she moves to an adjacent room; she never sleeps in the same room on two nights in a row and she always moves exactly one room left or right along the corridor
    - For example, if she is currently sleeping in room 12, then on the next night she will either be in room 11 or in room 13
    - If she is in room 1, then she must be in room 2 on the next night as she cannot move in any other direction (the same is true for room 17 – she must move to room 16 next)

A prince wishes to marry the princess. To do this he must find her room in the castle. However, whenever he sneaks into the castle at night, the guards quickly find him and throw him out! Therefore, he only has time to search one room each night.
The princess is unable to give the prince any clues to her location, and the prince has no knowledge of her location, other than whether or not she was in the room he last tried.

1. What strategy should the prince follow in order to find the princess in a finite time?
2. What is the maximum number of nights the prince needs to search before he can guarantee finding the princess?

Activity 4 – Databases

Watch the videos on databases on YouTube at: OCR A'Level Databases part 1

1. Make your notes
2. If you have MS Access at home, create your own normalized database

Activity 5 – Coding task

Write a program to:

1. Ask the user to input:
    - 1.1 The name of a product
    - 1.2 Its cost in pounds
    - 1.3 The program should keep asking for inputs until the user types ‘None’ or ‘Exit
2. The program should then output:
    - 2.1 The name and price of the most expensive item
    - 2.2 The name and price of the least expensive item
    - 2.3 The average price of the items
    - 2.4 The total cost of the items
        - 2.4.1. Items over £50 get a 5% discount
        - 2.4.2. VAT is added at the end at 20%
3. The program should validate any inputs.

- Plan your algorithm first, using a flowchart or pseudocode.
- Code your algorithm, and provide evidence of both your code and the outcome.
- Create a test plan for your algorithm to test for valid, invalid data.