Task A

There are two types of computer control: open loop system and feedback system.

In the table below tick whether the examples provided use an open loop or feedback system. Justify your answer.

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| **Example** | **Open loop** | **Feedback** | **Justification** |
| Putting the microwave on for two minutes. | ✓ |  | After cooking for two minutes, the control system turns the microwave off. It has no idea whether your food is still frozen, burnt or cooked perfectly. |
| Pre-heat an oven to 180 degrees. |  | ✓ | When the oven temperature is set, a light will come on to indicate that the oven is pre-heating. As once as the temperature reaches 180 then that light will turn off to indicate it’s at the temperature requested. |
| Anti-lock brakes in a car. |  | ✓ | Sensors on each wheel are used to detect 'locking' or when a wheel stops moving and starts to skid. When a lock-up is detected, ABS pumps the brakes, 100's of times a second. |
| Putting the dishwasher on an eco-setting which will wash for 30 minutes. | ✓ |  | After washing for thirty minutes, the control system turns the machine off. It has no idea whether all the plates and glasses are clean. |

Task B

Identify one advantage and one disadvantage to using an open loop system and feedback system.

Open loop system

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| Advantage:  It is very simple, all it does is take in a command or value and produces an output action of some kind.  Disadvantage:  No consideration for the output so may not always perform the way users intend it to. |

Feedback system

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| Advantage:  It provides more precise control  Disadvantage:  It’s more complicated to manufacture because of the reliance of the output being fed back to the input. |

Task C

In the table below identify whether a laptop (general purpose system) or a washing machine (special purpose embedded system) would be better and justify your choice.

Remember, the laptop will be using off-the-shelf systems software whereas a washing machine will use a very specific operating system.

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| **Criteria** | **Choice** | **Justification** |
| Which would be easier to regularly update? | Laptop | You are able to regularly update your operating system and this is usually prompted by your operating system. It would be difficult to do an upgrade on a washing machine. |
| Which one would be easier to transfer data from one device to another? | Laptop | You can easily transfer files using various forms of storage media such as optical, solid-state and cloud storage devices. There is no way of transferring data from a washing machines computer system. It doesn’t have any ports to plug and transfer data. |
| Which would be easier to manage? | Washing machine | Because it performs a specific set of functions and stores them instructions permanently, it becomes difficult to change. Whereas a laptop, many changes can be made which could affect how it performs over time. |
| Which one would be easier to reset/restore to original settings? | Laptop | You can format your hard disk or use system restore points on your laptop in order to fix any problems. This would be difficult to do on a washing machine. It might come up with an error code but would need a specialist technician to potentially fix the problem. |
| Which one would be the most cost effective? | Washing machine | Washing machine has one purpose and this is to wash clothes and won’t deteriorate in performance for a long time. Something can easily go wrong with a laptop such as a corrupt hard drive or an upgrade might be required for better performance which could get costly in the long run. |
| Which one would be the fastest to load? | Washing machine | You just need to turn the dial and the washing machine will respond in real-time and provide a response to the input. With a laptop there are too many variables: it might be slow to load due to the choice of storage or a fragmented hard drive for example. |
| Which one should perform each task with maximum efficiency? | Washing machine | Because there are pre-set functions that are completely dedicated to perform certain types of washes, there is no interruption. With a laptop it could be down to hardware or even choice of software that means it doesn’t complete each task effectively. |
| Which one is more vulnerable to malware? | Laptop | Washing machine has already been programmed with a permanent set of functions that cannot be changed and nothing can be written to it. Laptop uses memory such as RAM which can read and write data which makes it more vulnerable to malware. |

Task D

Automobiles such as cars contain a wide range of feedback systems.

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Identify feedback systems found in cars and identify their function/purpose.

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| **Feedback system** | **Purpose** |
| Cruise Control | An electronic device that allows a vehicle's driver to lock the accelerator on a specific speed and take his or her foot off of the pedal. |
| ABS (Anti-lock Braking System) | It prevents your car's wheels from locking up under hard braking, thereby maintaining more control and limiting the chances of your car skidding. |
| Transmission Control | Electronic sensors monitor the gear position selection, vehicle speed, throttle position and a number of other functions. |
| Electronic fuel injection | It injects fuel directly into an engine's manifold or cylinder using electronic controls. |
| Park assist | An automated parking aid that helps drivers park with greater precision, using guidance system technology that rivals ultrasonic and other camera-based solutions with superior, advanced technology. |

Answers will vary from student to student, especially when cars contain so many different features that perform specific functions.