

## CSC325 - Individual Assignment 2

1.) Critical path delay =  $35 + 5 + 40 + 5 + 28 + 5 + 42 + 5 + 30 + 5 + 38 + 5$

= 243 nanoseconds

To calculate the maximum clock frequency, we need to divide the clock period by the critical path delay: Maximum clock frequency =  $1 / (\text{Critical path delay}) = 1 / (243 \text{ ns}) = 4.12 \text{ MHz}$

Therefore, the maximum clock frequency with which the pipeline can operate is approximately 4.12 MHz

2A.) Using a microcontroller would be the best option in this situation. Microcontrollers can be programmed to monitor the vibration sensors, take readings, and wirelessly transmit the data, making them ideal for low-power applications. Microcontrollers can also be powered by tiny solar cells, are inexpensive, and are simple to integrate with wireless modules.

In this case, neither an FPGA nor an ASIC would be the best option. ASICs are used for high-performance and high-volume production, while FPGAs are frequently used for rapid prototyping and custom hardware development. Both FPGAs and ASICs would need a lot of design work and money to implement, making them less suitable for low-power applications.

In summary, the best option for creating wireless sensors would be a microcontroller-based one.

2B.) The best option in this scenario would be to use an FPGA. FPGAs can be programmed to interface with a wide range of sensors and other devices, including analog sensors, pulse-width-based sensors, and I2C devices, and are well-suited for high-speed, real-time signal processing applications. FPGAs can interface with USB devices and are excellent for controlling motors and servos as well.

A solution that can handle high-speed data transfer is also necessary due to the high data rate of 100KB per second. An FPGA-based solution can handle real-time data processing and the USB connection interface.

A microcontroller-based solution might be able to connect to a variety of sensors and gadgets, but it might not be able to handle high data rates and real-time processing.