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**Student : Name:_____ Roll No._____**
**Section:_____**

# Question 1 [5+5]

**a) What is the effect of Pipelining on Latency of a single instruction and throughput? Tell for each one of them either it increases or decreases? Briefly describe the reason behind it.**

**b) A program of 1000 instructions executes in 5 milliseconds on a computer with 400 KHz clock. Calculate the average CPI?**

# Question 2 [10]

**An unpipelined processor takes 10 ns to work on one instruction. It then takes 0.2 ns to latch its results into latches. We were able to convert the circuits into 8 pipeline stages. The stages have the following lengths: 1.3ns; 0.7ns; 0.8ns; 1.2ns; 1.4ns; 0.4ns; 1.5ns; 1.3ns. Answer the following, assuming that there are no stalls in the pipeline.**

1. **What are the clock speeds in both processors?**

2. **How long does it take to finish a single instruction in both processors (in nano-seconds and cycles)?**

3. **What is the throughput for each processor?**

4. **What is the speedup provided by the 8-stage pipeline?**