|  |  |  |  |
| --- | --- | --- | --- |
| Question | Bash/shell | Python | C |
| Min and Max | -40mV, 3.32V | -40mV,3.32V | -40mV,3.3V |
| Period | 236.3ms | 200ms | 100.8ms |
| Close to 100ms | ~double | ~double | Yes |
| Why differ | Timing not accurate | Python interpretation | Swap instructions |
| Htop | 2.6% | 0.7% | 0.7% |
| Stable? | yes | Yes | Yes |
| Launching program | Still stable until nearing shortest period | Still stable until nearing shortest period | Yes |
| Shell performance | Optimizations do little to help | - | - |
| Shortest period | 38.6ms | 2.3ms | 400us |

Figure 1: general test

|  |  |  |
| --- | --- | --- |
| Timing Setting | CPU Usage | Frequency |
| 0.15 | 2.6% | 2.98Hz |
| 0.1 | 2.6% | 4.25Hz |
| 0.075 | 3.3% | 5.411Hz |
| 0.05 | 5.2% | 7.391Hz |
| 0.025 | 7.2% | 11.68Hz |
| 0.01 | 12.4% | 17.82Hz |
| 0.001 | 19.4% | 26.53Hz |

Figure 2: bash test

|  |  |  |
| --- | --- | --- |
| Timing Setting | CPU Usage | Frequency |
| 0.15 | 0.6% | 3.326Hz |
| 0.1 | 0.6% | 4.985Hz |
| 0.075 | 0.6% | 6.645Hz |
| 0.05 | 0.6% | 9.95Hz |
| 0.025 | 1.3% | 19.84Hz |
| 0.01 | 1.3% | 49.02Hz |
| 0.001 | 12.1% | 434.7Hz |

Figure 3: python test

|  |  |  |
| --- | --- | --- |
| Timing Setting | CPU Usage | Frequency |
| 0.15 | 0.6% | 6.63Hz |
| 0.1 | 0.6% | 9.985Hz |
| 0.075 | 0.6% | 15.31Hz |
| 0.05 | 0.6% | 19.88Hz |
| 0.025 | 1.3% | 39.53Hz |
| 0.01 | 1.3% | 97Hz |
| 0.001 | 14.3% | 834Hz |
| Max: 400us | 55.5% | 2.5kHz |

Figure 4: C test

|  |  |  |
| --- | --- | --- |
| Timing Setting | CPU Usage | Frequency |
| 150000us | 0.0% | 3.33Hz |
| 100000us | 0.0% | 5.0Hz |
| 75000us | 0.2% | 6.666Hz |
| 50000us | 0.2% | 9.998Hz |
| 25000us | 0.0% | 19.94Hz |
| 10000us | 0.0% | 49.5Hz |
| 1000us | 2.7% | 461.1Hz |
| Max: 1us | 39.5% | 6.4kHz |

Figure 5: Mmap test