1 Exercise 1

(a) Processor: 6 core Intel(R) Xeon(R) E-2176G, Coffeelake based

(b) Base: 3.70GHz

(c) Max: 4.50GHz with TurboBoost 2.0

(d) Phase: Optimization

(e)
- SSE2 supports vector operations using 128-bit registers.
- SSE2 generally has better throughput than x87
- x87 works on 80-bit floating-point precision
- x87 support also trigonometric functions
- SSE2 has a register based programming model whereas x87 is stack based

(f) 2 FMA / cycle = 4 FLOP / cycle

(g) *MULSS/D*: Latency = 4 cycles, Throughput = 2 per cycle

(h) *SQRTSS/D*: Latency = 12, Throughput = 0.33 per cycle

(i) *ROUNDD*: Latency = 8, Throughput = 1 per cycle

2 Exercise 2

(a) $FLOPs = n * n * (1 + n * 2) = 2 * n^3 + n^2$

(b) $Memory = 2 * 8 * n^2$; $Opintensity < n^8 flops/byte$

3 Exercise 3

(a) $C(n) = C_{add} * N_{add} + C_{mult} * N_{mult} + C_{max} * N_{max}$

(b) $C(n) = C_{add} * 3n + C_{mult} * 3n + C_{max} * 1n$

(c)
- 0.5 cycle/flops * 7n flops = 3.5n cycles
- 0.5 cycle/flops * 6n flops = 3n cycles
- – L3: 1/4 cycle/double * 5n double = 5n/4 cycles
  – Main: 1/2 cycle/double * 5n double = 5n/2 cycles

(d) $Intensity : 6nflops/(5n * 8)byte = 3/20flops/byte$