CSE 513 Parallel Runtimes for Modern Processors, Quiz 03 Winter 2024
Time allocated: 12:00pm – 12:20pm

Name	
Roll Number	

Instructions:

- This is a closed book and closed notes quiz. Please be aware of strict plagiarism policy.
- For questions requiring justification, please be as concise as possible. 2-3 sentences would be the ideal size of a justification. No extra pages will be provided.

Question 1: A 20-core 8-way SMT processor supporting AVX512 instruction set can process how many indices of a floating-point array in each CPU cycle? Assume infinite memory bandwidth such that there are no memory stalls in the processor, and there are no other applications running on the processor. Briefly justify. **[2 marks]**

Answer:

Total floats processed / cycle = 512/32 * 20 = 16*20 = 320. [+1 marks]

It won't be 320 * 8 as ALUs are shared between SMT threads per core. [+1 marks]

Question-2: Write vectorized code using VCL for Figure-1 using Vec4i. Use **exact syntax** to get marks **[3 marks]**.

Answer:

```
int A[1024];
std::fill(A, A+1024, 1);
```

Figure-1

```
Vec4i B(1);                    //+1 marks
for(int i=0; i<1024; i+=4) {   //+1 marks
    B.store(A+i);              //+1 marks
}
```

Question-3: What will be the speedup of a parallel application having parallel fraction f=0.4 on a symmetric multicore processor PA where each core has R=4 processing resources? Total R on PA is 8. Provide the formula as well (the one taught in lecture slides) **[2 marks]**

Answer:

Speedup = 1 / { (1-f) / Perf(R) + f*R / Perf(R)*N } //+1 marks

PA = 1 / { 0.6/2 + (0.4 * 4) / (2 * 8) } = 1 / (0.3+0.1)

= 2.5x //+1 marks

Question-4: Name any four features to justify that multicore processors in desktop are latency-oriented v/s GPU processor that are throughput oriented (e.g., Intel GPUs). **No** justifications required. **[0.75 x 4 = 3 marks]**

Answer:

a) High frequency core
b) Large caches
c) Superscalar execution
d) Out of order execution
e) etc.