Discussion Questions

Data Dependences

For all of the problems, assume the SIMD vector size is 4.

1. Compute the data dependences for the following loop. Then, based on the dependence graph, determine if the loop is vectorizable or no.

   for (int i = val ; i < LEN ; i ++) {
      a[i] = a[i-4] + b[i];
   }

2. Compute the data dependences for the following loop based on the value of \( k \). In particular, compute the data dependences when \( k = 1 \) and when \( k = -1 \). Then, determine what values of \( k \) the loop is vectorizable for.

   for (int i = val ; i < (LEN - k) ; i ++) {
      a[i] = a[i+k] + b[i];
   }
3. Compute the data dependences for the following loop. Then, determine if the loop can be vectorized.

```c
for (int i = 1 ; i < LEN ; i ++) {
    a[i] = b[i] + c[i];
    d[i] = a[i] + e[i-1];
    e[i] = d[i] + c[i];
}
```

4. Consider the following code and determine if it is safe for the compiler to vectorize it.

```c
void func1(float *a, float *b, float *c) {
    for (int i = 0; i < LEN; i++) {
        a[i] = b[i] + c[i];
    }
}
```