Quiz Questions for Module 9

1. For the following basic reduction kernel code fragment, if the block size is 1024 and warp size is 32, how many warps in a block will have divergence during the iteration where stride is equal to 1?

```
unsigned int t = threadIdx.x;
Unsigned unsigned int start = 2*blockIdx.x*blockDim.x;
partialSum[t] = input[start + t];
partialSum[blockDim.x+t] = input[start+ blockDim.x+t];
for (unsigned int stride = 1; stride <= blockDim.x; stride *= 2)
{
    __syncthreads();
    if (t % stride == 0) {partialSum[2*t]+= partialSum[2*t+stride];}
}
```

(A) 0
(B) 1
(C) 16
(D) 32

Answer: (A)
Explanation: During the first iteration, all threads in each warp are active. There is no control divergence.

2. In the Question 1, how many warps in a block will have divergence during the iteration where stride is equal to 16?

(A) 0
(B) 1
(C) 16
(D) 32

Answer: (D)
Explanation: During each iteration, 1/stride of the threads in each warp are active. When stride is 16, every warp will have 32/16= 2 active threads that execute the addition statement. All 32 warps will have control divergence.

3. In the Question 1, how many warps in a block will have divergence during the iteration where stride is equal to 64?

(A) 0
(B) 1
(C) 16
(D) 32

Answer: (C)
Explanation: There will be one active thread in every 64 threads or 2 warps. So, 1/2 of the wraps or 16 warps have divergence. The other ¾ of the warps have only inactive threads and thus no divergence.

4. For the following improved reduction kernel, if the block size is 1024 and warp size is 32, how many warps will have divergence during the iteration where stride is equal to 16?

```
unsigned int t = threadIdx.x;
Unsigned unsigned int start = 2*blockIdx.x*blockDim.x;
partialSum[t] = input[start + t];
partialSum[blockDim.x+t] = input[start+ blockDim.x+t];
for (unsigned int stride = blockDim.x; stride > 0; stride /= 2)
{
    __syncthreads();
    if (t < stride) {partialSum[t] += partialSum[t+stride];}
}
```

(A) 0
(B) 1
(C) 16
(D) 32

Answer: (B)
Explanation: In each iteration, there are stride consecutive active threads. During the iteration where stride is 16, there are 16 consecutive active threads, all in the same warp. All other threads have only inactive threads. So one warp has control divergence and 31 will not.

5. In the previous question, how many warps in a block will have divergence during the iteration where stride is 64?

   a. 0
   b. 1
   c. 16
   d. 32

Answer: (A)
Explanation: There are 64 consecutive active threads, which is a multiple of warp size. So two warps will have all their threads active and 30 warps will have all their threads inactive. None of them will have control divergence.