

Practice questions for OpenMP

August 22, 2018

Overview

1. These questions are to familiarize you to Openmp parallel computing environment
2. Some of the code might have bugs but not all of them do
3. You can assume the syntax of the code (e.g order of arguments, array allocation calls, name of variables etc.) is correct
4. You can focus on the logic of the code, and ignore performance issues
5. You can assume that the number of OpenMP threads are greater than 1

Question 1

Given 2 snippets below: The first snippet code is the serial (original) program, and the second snippet code is its parallel version (i.e trying to do the same thing)

Listing 1: code snippet (serial) for question 1

```
1  int sum = 1;
2
3  // increase sum by 10 using a loop
4  for (int i = 0; i < 10; i++) {
5      sum +=1;
6  }
```

Listing 2: code snippet (parallel) for question 1

```
1  int sum = 1;
2
3  // increase sum by 10 using openmp
4  #pragma omp parallel reduction(+ :sum)
5  for (int i = 0; i < 10; i++) {
6      sum +=1;
7  }
```

1. Will the parallel program terminate without error ?
2. If the program terminates, will the value of *sum* in the parallel program be the same as the value of *sum* in the serial program ?

Question 2

Given the snippet below:

Listing 3: code snippet (serial) for question 2

```
1  int T[10];  
2  
3  // initializing array T using openmp  
4  #pragma omp parallel for private(T)  
5  for ( int i = 0; i < 10; i ++ ) {  
6      T[i] = i;  
7  }
```

1. Will the parallel program terminate without error ?
2. If the program terminates, what will be the value of array T ?

Question 3

Given the snippet below:

Listing 4: code snippet (serial) for question 3

```
1  int sum = 1;
2  int i;
3
4  // increase sum by 10 using openmp
5  #pragma omp parallel for shared (i) reduction (+: sum)
6  for ( i = 0; i < 10; i++) {
7      sum +=i;
8  }
```

1. Will the parallel program terminate without error ?
2. If the program terminates, what will be the value of *sum* ?

Question 4

Given the snippet below:

Listing 5: code snippet (serial) for question 4

```
1  int sum = 1;
2
3
4  // increase sum by 10 using openmp
5  #pragma omp parallel
6  {
7      #pragma omp for reduction (+: sum)
8      for ( int i = 0; i < 10; i ++) {
9          #pragma omp critical
10         {
11             sum +=1;
12         }
13     }
14 }
```

1. Will the parallel program terminate without error ?
2. If the program terminates, what will be the value of *sum* ?

Question 5

Given the snippet below:

Listing 6: code snippet (serial) for question 5

```
1  int T[5];
2  int sum = 0;
3
4  // initializing array T
5  for ( i = 0; i < 10; i ++ ) {
6      T[i] = i;
7  }
8
9  // running the loop 10 times using openmp
10 #pragma parallel for shared (T,sum) reduction (+ : sum)
11 for ( int i = 0; i < 10; i ++ ) {
12
13     // assign value for elements in array T
14     for (int j =0; j < 5; j++) {
15         T[j] = i ;
16     }
17
18     // increase "sum" by the toatl of T array module by 2
19     sum += (T[0] + T[1] + T[2] + T[3] + T[4]) % 2;
20 }
```

1. Will the parallel program terminate without error ?
2. If the program terminates, what will be the value of *sum* ?

Question 6

Listing 7: code snippet (serial) for question 6

```
1  int T[10];
2
3  // initializing array T
4  for ( i = 0; i < 10; i ++) {
5      T[i] = i;
6  }
7
8  // running the loop 10 times using openmp
9  // increase all element in array T by 1 each iteraion
10 #pragma parallel for shared (T)
11 for ( int i = 0; i < 10; i ++) {
12     for (int j =0; j < 10; j++) {
13         T[j] +=1;
14     }
15 }
```

1. Will the parallel program terminate without error ?
2. If the program terminates, what will be the value of array T ?

Question 7

Given 2 snippets below: The first snippet code is the serial (original) program, and the second snippet code is its parallel version (i.e trying to do the same thing)

Listing 8: code snippet (serial) for question 7

```
1 int sum = 1;
2 int i = 1;
3
4 // increase sum by one each iteration
5 for (i; i < 10; i ++) {
6     sum +=1;
7 }
```

Listing 9: code snippet (parallel) for question 7

```
1 int sum = 1;
2 int i =1;
3
4 // increase sum by one each iteratiob using openmp
5 #pragma omp parallel for private(i) reduction( + : sum )
6 for (i; i < 10; i ++) {
7     sum +=1;
8 }
```

1. Will the parallel program terminate without error ?
2. If the program terminates, will the value of *sum* in the parallel program be the same as the value of *sum* in the serial program ?

Question 8

Given 2 snippets below: The first snippet code is the serial (original) program, and the second snippet code is its parallel version (i.e trying to do the same thing)

Listing 10: code snippet (serial) for question 8

```
1 int sum = 0;
2 int i = 0;
3
4 // increase sum by one each iteration
5 for (i; i < 10; i++) {
6     sum +=1;
7 }
8
9 int equal = (sum == i);
```

Listing 11: code snippet (parallel) for question 8

```
1 int sum = 1;
2 int i = 0;
3
4 // increase sum by one each iteratiob using openmp
5 #pragma omp parallel for private(i) reduction( + : sum )
6 for (i; i < 10; i ++ ) {
7     sum +=1;
8 }
9
10 int equal = (sum == i);
```

1. Will the parallel program terminate without error ?
2. If the program terminates, will the value of *equal* in the parallel program be the same as the value of *equal* in the serial program ?