

CSE 340 Midterm 1

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I. QUESTION (15 POINTS)

Write a parallel function which finds the number of perfect numbers smaller than 10^{12} . A number is perfect if it is equal to the sum of its positive divisors excluding itself. 6 is a perfect number $6 = 1 + 2 + 3$, 28 is a perfect number $28 = 1 + 2 + 4 + 7 + 14$.

II. QUESTION (15 POINTS)

Write a parallel function that checks whether the local subarrays of an array are equal or not. Assume that all processors have n/p elements of the array with name *local*. Assume also that the array only contains 0 or 1's.

```
void areIdentical(int* local, int N,
                 int p, int id)
```

III. QUESTION (15 POINTS)

Write a parallel function

```
void evaluate(double* local, int N,
             int p, int id)
```

which evaluates the following number $\frac{a_0}{0!} + \frac{a_1}{1!} + \dots + \frac{a_{n-1}}{n-1!}$. Assume that the coefficients a_i are distributed to processors and all processors have n/p elements of the array *a* with name *local*. First processor will print the result.

IV. QUESTION (15 POINTS)

Write a parallel function that searches an integer array for a number *k*. Assume that all processors have n/p elements of the array with name *local*. Your function will print the index of the number *k*. You can suppose that all elements of the array are distinct.

```
void search(int* local, int N,
           int p, int id, int k)
```

V. QUESTION (20 POINTS)

Write a parallel function that sorts an integer array containing only 0's and 1's. Assume that all processors have n/p elements of the array with name *local*.

```
void bucketsort(int* local, int N,
               int p, int id)
```

VI. QUESTION (20 POINTS)

Write a parallel function that finds the *k*'th largest element of an array containing positive numbers. Assume that all processors have n/p elements of the array with name *local*. First processor will print the result.

```
void kthlargest(int* local, int N,
               int p, int id)
```