Programming Assignment #4: Quick Sort with a Thread Pool

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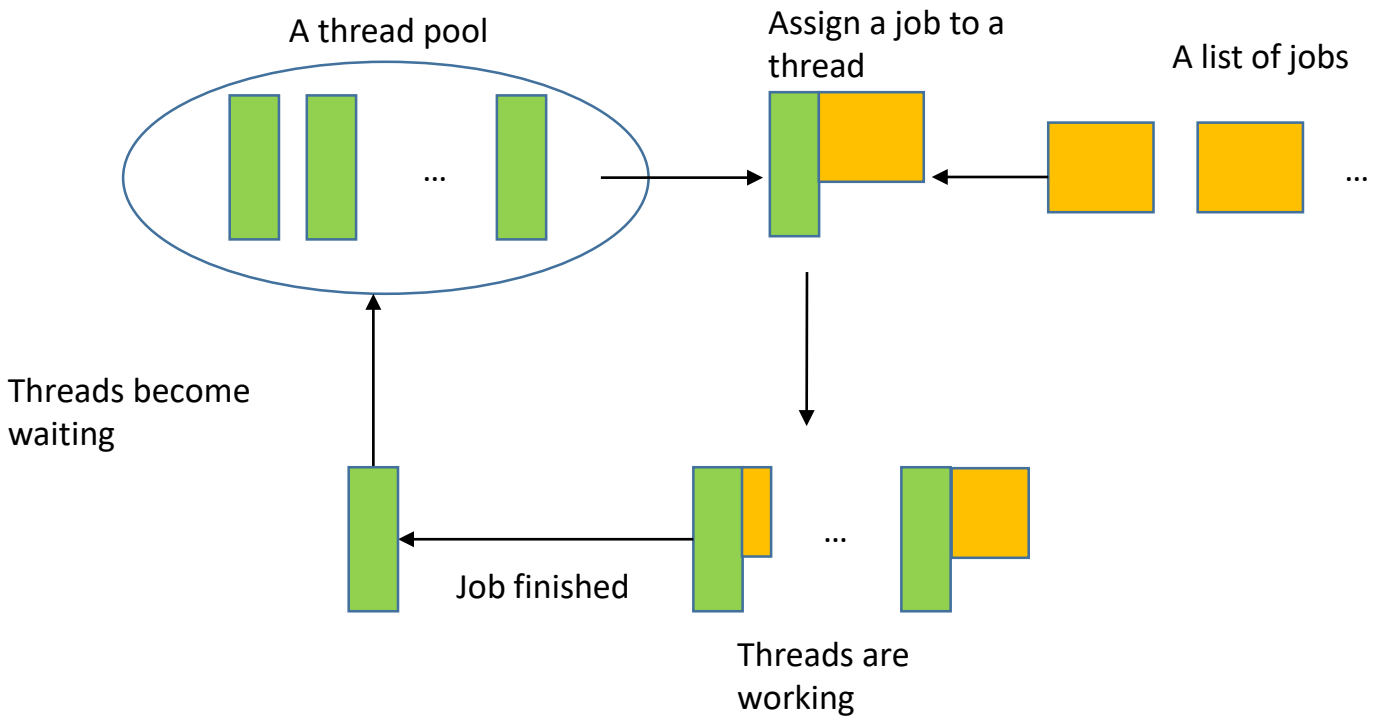
Objective

- Multithreaded sorting using a thread pool
  - # of threads in the pool determines the max. degree of parallelism
- The problem definition is the same as that in the previous assignment, except that the binding of sorting jobs to threads is dynamic

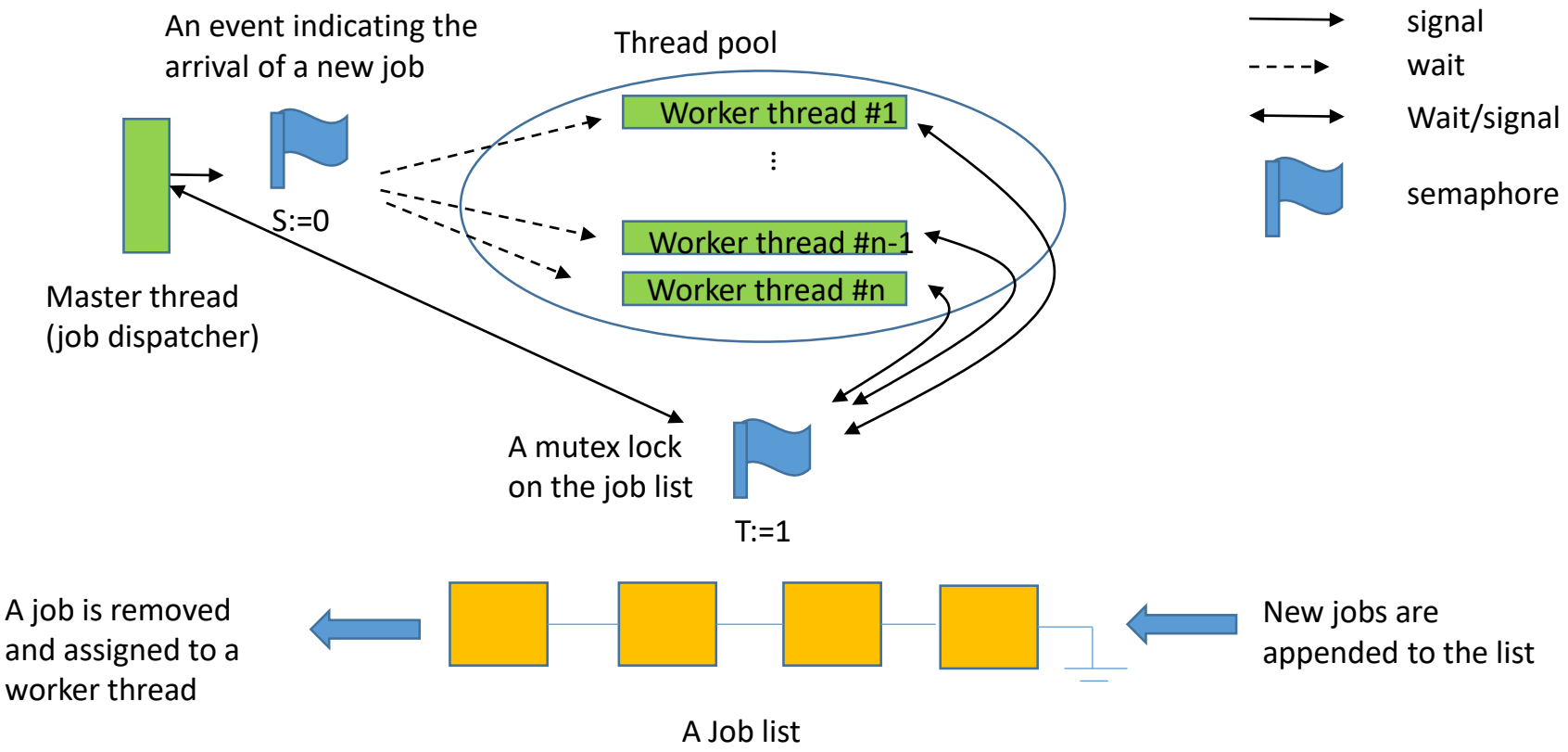
Job Binding

- A job is
  - Partitioning an array into two small sub-arrays, or
  - Sorting a last-level array using bubble sort
- All worker threads are created before the first job starts

The Concept of a Thread Pool



A Reference Implementation



Procedure

1. Read data from the input file “input.txt”
2. n=1
3. Do the sorting with a thread pool of n threads
4. Print the execution time
5. Write the sorted array to a file
   - Filename: output_n.txt (e.g., output_3.txt if n=3)
6. n++; if n<=8 then goto 3

Remarks

- Reuse your assignment 3
- The binding of jobs to threads must be dynamic
- All the 8 output files must be identical
- Execution time decreases as *n* increases
- Performance improvement saturates as *n* increases

Input/Output Format

- Format of “input.txt”:

<# of elements of array><space>\n

<all elements separated by space>

  - Largest input: the same as in assignment #3

- Output file format:

<sorted array elements separated by space>

Testing OS Environment

- Ubuntu 16.04, Ubuntu 14.04 or CS linux work station
  - Your code should compile successfully in one of the above environments