1. C -

Concurrency & Parallelism

Sample Test

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And so we can conclude that having 70% of the code run

2. C - Partitioning is part of the process of parallelization of an algorithm. In this case, task partitioning.

3. B -

4. C - MapReduce operates on arbitrary kinds of elements, it is up to the programmer.

5. D - Also called the master/slave pattern, farm works over streams since the tasks are distributed by the master.

6. C - Map works over collections, the only statement which does the same is C.

7. B - In line 4 the statement combines two elements using f, thus we have a reduce pattern.

8. B - From the IBM documentation1 we have: *The omp single directive identifies a section of code that must be run by a single available thread.*

9. B - From the moment the stack is popped local variables (not allocated on the heap) become invalid.

10. A - Monte Carlo methods, are a broad class of computa tional algorithms that rely on repeated random sampling to obtain numerical results.2

11. D - RAW, WAR and WAW affect the correctness of the program given the program is only correct if the depen dency relationship is uphold.

12. D - If we run some iterations of the loop we see a[1][0] = a[0][1], a[1][2] = a[0][3], a[2][0] = a[1][1], a[2][2] = a[1][3]. Thus there are no dependencies between loop iterations.

13. D - If we assume the whole program takes *T* time to run we have:

0*.*5*T* + 0*.*5*T*

100= 0*.*505*T*

0*.*1*T* + 0*.*9*T*3= 0*.*4*T*

0*.*4*T* + 0*.*6*T*50= 0*.*412*T*

0*.*3*T* + 0*.*7*T*30= 0*.*323*T*

1https://tinyurl.com/y7qszwxh

2https://en.wikipedia.org/wiki/Monte\_Carlo\_method

30 times faster is the better choice.

14. A - It is the formula.

15. C & D

• C - The span is the minimum schedule length.

• D - The span is defined as the critical-path length, that is, the minimum of steps the algorithm must execute.

16. D - See Question 15.

17. B - A thread cannot acquire a lock if it is not free, thus the holder thread must first release it, synchronizing both events.

18. D - When the queue is empty *n* = 0 and thus the impli cation does not apply.

19. D - We cannot make guarantees about *T*(*op*) based on *Te*(*op*).

20. D - The implementation does not ensure progress since the processes can be synchronized and do the following:

(a) Put their flag up.

(b) See the other flag as up.

(c) Put their flag down.

(d) Since their flag is not up this process repeats *ad eternum*.

However the implementation provides mutual exclusion since both processes are unable to access the critical region at the same time.

21. C - The lock-freedom condition states that when the pro gram threads are run sufficiently long, at least one makes progress.

22. A - Iterate the list until we arrive at the possible candi date.

23. B - We validate the previous and current nodes to check for deletions and ”chain” correctness, that is pred.next == curr.

24. A - We see if the key exists, if it does we check if it is not marked for deletion.

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25. B - The *LockSet* is initialized to the universal set.

26. D - We first compute the maximal views of the threads:

*M*(*T*1) = *V*1

*M*(*T*2) = *V*2

*M*(*T*3) = *V*4

Comparing *M*(*T*1) with the other thread’s views:

*V*2 *⊆ M*(*T*1)

*V*3 *⊆ M*(*T*1)

Comparing *M*(*T*2) with the other thread’s views:

*M*(*T*2) *⊆ V*1

*V*3 \* *M*(*T*2) *∧ M*(*T*2) \* *V*3

We have an high-level data race.

27. A - When a new process enters a system, it must declare the maximum number of instances of each resource type that it may ever claim; clearly, that number may not exceed the total number of resources in the systems.3

28. C - See the labs.

3https://en.wikipedia.org/wiki/Banker’s\_algorithm 2