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1. Hardware and software are the two different styles of parallelism. For hardware, A computer can have multiple CPUs, multiple Cores on a CPU, or a combination of both. The multiple cores/CPUs allow the computer to execute different programs simultaneously. When it comes to writing software you can run code in parallel as long as the code segments are not dependant on each other.
2. The three paradigms are Shared Memory, Message Passing, and Data Parallel. Shared Memory allows multiple processors to access the same block of memory. Message passing allows processes to communicate by sending explicit send/receive pairs.
   Data parallel is when a single thread of control consisting of parallel operations. The operations are applied to all or a subset of a data structure.
3. Shared address space machines allow the processors to access all of the memory in the machine whereas in a distributed address space machine each processor receives a portion of the memory that they are allowed to access and cannot access any other processors memory.
   The advantages of distributed machines are that they can hide data movement and simplify the data sharing protocol. They are also cheaper to build and can use normal hardware to implement. WIth that being said memory access times across memory pools are fairly slow and inefficient.
   An advantage of shared memory is data sharing is fast and uniform between CPUs. A disadvantage of shared memory is the lack of scalability of memory and processors, and they are more expensive to build since they need specialized hardware.
4. An anti-dependency is where you have a write after read.
   An example of this is: x = 4, y = x/2.
   One way to remove an anti-dependency is by using a temporary variable.
   X = 4
   Tmp = X
   Y = tmp/2
5. A. In DFS it takes 11 units to find the solution.
   B. P1 finds the solution in 4 units. Speedup equals Ts/Tp, 11/4 = 2.75.
   Since we only had 2 cores the time it takes to find the solution should be twice as fast but since it is faster than that it is considered a superlinear anomaly. The work done by the parallel algorithm is less than when performed by a single processor algorithm.
6. Avg. Access = H1*D1 + (1-H1)*(H2*D2 +(1-H2)*(H3*D3 + (1-H3)(HM*DM + (1-HM))))
   Avg. Access = 0.4*2 + (1-0.4)(0.7*8 +(1-0.7)(0.9*30 + (1-0.9)(1*100 + (1-1))))
   Avg. Access = 0.8 + (0.6)(5.6 + 0.3(27 + .1(100)))
   Avg. Access = 0.8 + (0.6)(5.6 + 0.3(37))
   Avg. Access = 0.8 + (0.6)(16.7)
   Avg. Access = 0.8 + 10.02
   Avg.Access = 10.82ns

7. A. Ts = 2nm

   B. Tp = (2nm/p) +m

   C. Sp = Ts/Tp = (2nm) / (2nm/p) +m

      Sp = 1 / (a + (1-a) / p

      2nm / 2nm/p + m = 1 / (a + (1-a) / p)

      2nmp/ 2nm + pm = 1 / (a + (1-a)/p)

      2np / 2n+ p = 1 / (a + (1-a)/p)

      2np / 2n+ p = p / (ap +1-a)

     (ap+1-a)(2np) = p(2n+p)

     Ap +1-a = 2np+p^2 / (2np)

     Ap+1-a = 1+p/2n

     Ap -a = 1 + p/2n -1

    a(p-1) = p/2n

    A = p/2n(p-1)

   D. This is an effective algorithm because as n approaches infinity alpha does approach 0