Exercise 2

Time tip: Roughly 45sec to 1min per 1pt
Q1) [3pts] Which of the following is/are (a) major reason(s) for the rising adoption of cloud computing?

A  Pay-as-you-go economics
B  Manageability
C  Data privacy
D  Both A & B
E  All of A, B, & C
Q2) [3 x 3pts] Suppose an SQL query takes 20min to run on a single worker node and x min when run on 5 worker nodes. What is the speedup for the given value of x? Is the speedup linear, sublinear, or superlinear?

A. x = 7min
B. x = 4min
C. x = 3min
Q3) [3 x 3pts] Suppose an ML training workload takes 40min to run on a single worker node. We then triple the dataset size, say, to help improve accuracy and use 3 worker nodes. It now takes $x$ min. What is the scaleup speedup for the given value of $x$? Is the scaleup linear, sublinear, or superlinear?

A. $x = 50\text{min}$
B. $x = 40\text{min}$
C. $x = 35\text{min}$
Exercise

Q4) [4pts] What is the speedup yielding by this task-parallel schedule on 3 workers against 1 worker?

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<thead>
<tr>
<th>W1:</th>
<th>T1</th>
<th>T1</th>
<th>T4</th>
<th>T4</th>
<th>T6</th>
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<tbody>
<tr>
<td>W2:</td>
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<td>W3:</td>
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<td>T3</td>
<td>T3</td>
<td>T3</td>
<td>T5</td>
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0  5  10  15  20  25  30

A  2
B  2.33
C  2.5

D  2.67
E  3
Q5) [5pts] Consider the same Gantt Chart as in Q4. Suppose you are given that T6 and T5 depend on T2. What will be the new speedup with 3 more workers for task-parallel execution? Explain your answer succinctly.
Exercise

Q6) Consider the following task graph with the task lengths shown. You are given 3 workers to execute this graph in a task-parallel manner like discussed in class.

A. [3pts] What is the lowest possible completion time of this workload?

B. [5pts] What is the highest possible speedup of this workload on 3 workers vs its runtime on just 1 worker without idling?

C. [5pts] What is the total idle time across all workers in a schedule that yields the highest speedup?
Q7) Consider the following task graph with some task lengths shown and some unknown/hidden.

A. [2pts] What is the degree of parallelism in this task graph?

B. [4pts] You are given that the lowest possible completion time of this workload is 30. What are the maximum possible values of x and y?

C. (Advanced; Optional) [8pts] Instead of B, you are now given that y = 2x. What is the highest possible speedup for this workload with task-parallel execution?
(Advanced; Optional) Q8) [8pts] You are given a workload with \(n\) tasks, each of length \(k\) units. You are allowed to use task parallelism as discussed in class. What is the lowest possible completion time of this workload? What should the task graph look like for that and how many workers are necessary to achieve that completion time?