Problem set 2

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Question 1: The idea of NUMA is that each processor has some assigned local memory such that it has the quickest access to. That does not mean it can not access other parts of the memory, it is only accessed slower. Tree structure can give NUMA effect.

Question 2: Amdahl's law assumes we work on the same problem on parallel and sequential computers, while Gustafson's law assumes the problem scales depending on number of processors. Therefore, one shows there exists a limit regardless of number of processors, while the other shows the limit does not exist, respectively.

Question 3: Strong scaling and Weak scaling show relation between speedup and number of processors. Strong scaling derives from Amdahl's law while the other from Gustafson's law. They both show how increasing the number of processors apply to the speedup, depending on the fraction of sequential operations.

Question 4: For speedup we use $S(p) = T_s/T_p$ and for efficiency $E(p) = S(p)/p$.

# of processors	time (s)	speedup (average)	efficiency (average)
1 (sequential)	51.076218	–	–
2	27.367532 27.368014	1.866290	0.933145
4	17.157435 17.157480 17.157414 17.158137	2.976883	0.744220
8	16.032788 16.032670 16.032557 16.032711 16.032677 16.032464 16.032243 16.033235	3.185759	0.398219