Assignment 1: Simulator

CS 231P: Parallel and Distributed Computing

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Introduction:

This report is based on a simulation which explores the relationship between the access time of memory modules by processors within a system and how it varies based on different configurations and workload attributes. In this report, we present the simulation results, discuss the significance of the memory request distribution, and provide recommendations based on our findings.

Simulation Results:

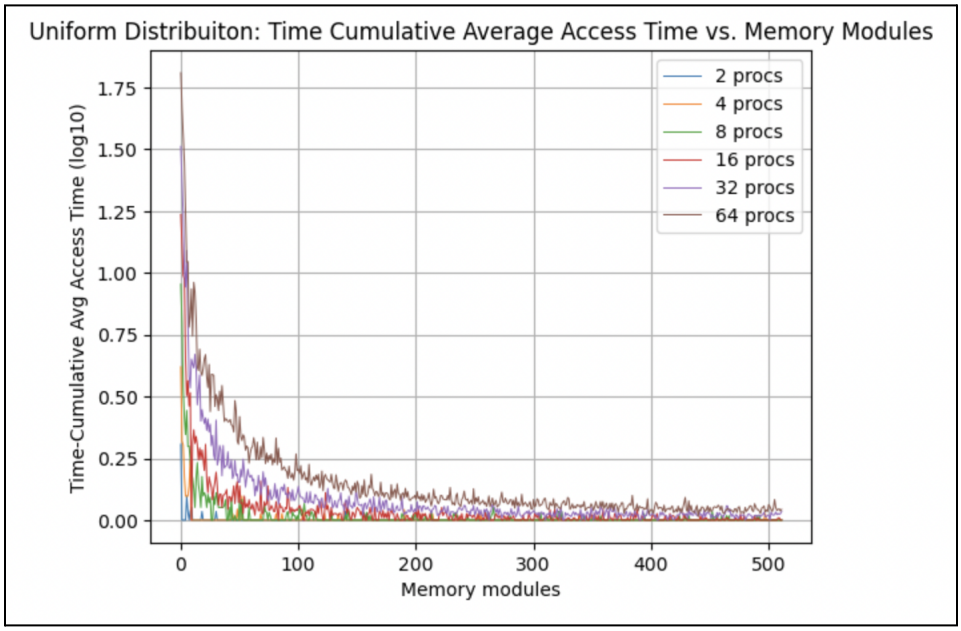


Chart 1: Uniform Distribution of Memory Requests

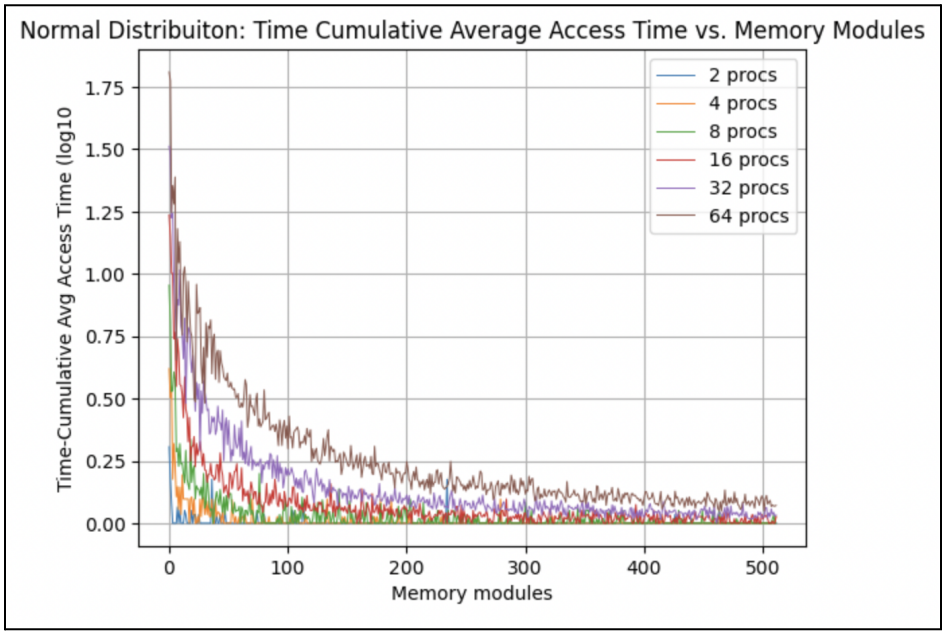
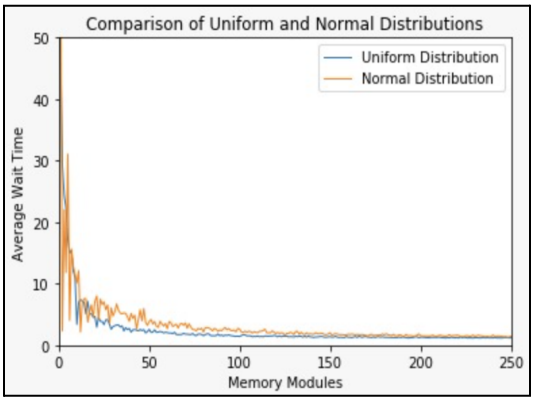


Chart 2: Normal Distribution of Memory Requests

Analysis and Interpretation of the Results:



Upon examining the provided graphs, it's evident that there are distinctions between the uniform and normal distribution's effects on cumulative average access time with regard to memory modules.

Uniform Distribution: In the uniform distribution graph, we observe that as the number of processors increase, there's a notable decrease in average access time during the initial memory modules. This is especially evident for higher processor counts (e.g., 64 procs) where the decrease is quite steep. Post this initial drop, the access times appear to stabilize across all processor counts, showing minor fluctuations beyond around 200 memory modules but remaining relatively consistent.

Normal Distribution: The normal distribution graph, on the other hand, showcases a similar initial steep decrease in average access time, but with slightly more variability. The stabilization post this decrease also appears to be more volatile compared to the uniform distribution. Higher processor counts, again, tend to have sharper decreases.

Discussion:

1. Impact of Memory Request Distribution

In a uniform distribution, memory requests spread evenly, leading to predictable access times that initially drop and then stabilize. In a normal distribution, requests center around a midpoint with fewer outliers, causing access times to drop sharply then fluctuate due to unpredictable request patterns. The same pattern is observed in the graphs above.

In real-world scenarios, memory access patterns would be less predictable and tend to follow a pattern more akin to the normal distribution. This can be due to various factors like caching, frequently used data structures, or popular memory addresses. Hence, the normal distribution appears to be a more realistic representation.

2. Recommendation for Memory Module Purchase

Based on the simulation, it is essential to consider both performance and cost-effectiveness when buying memory modules. The sharp decrease in average access times indicates that adding more memory modules initially results in significant performance gains. However, the diminishing returns after a certain point suggest that continually adding memory might not provide proportional benefits.

Given the data, It is better to invest in a moderate number of high-quality memory modules, for example 200 for uniform distribution as the graph stabilizes after that.

Conclusion:

In conclusion, the provided graphs offer valuable insights into how different distributions can impact system performance and should guide any investment in memory modules.