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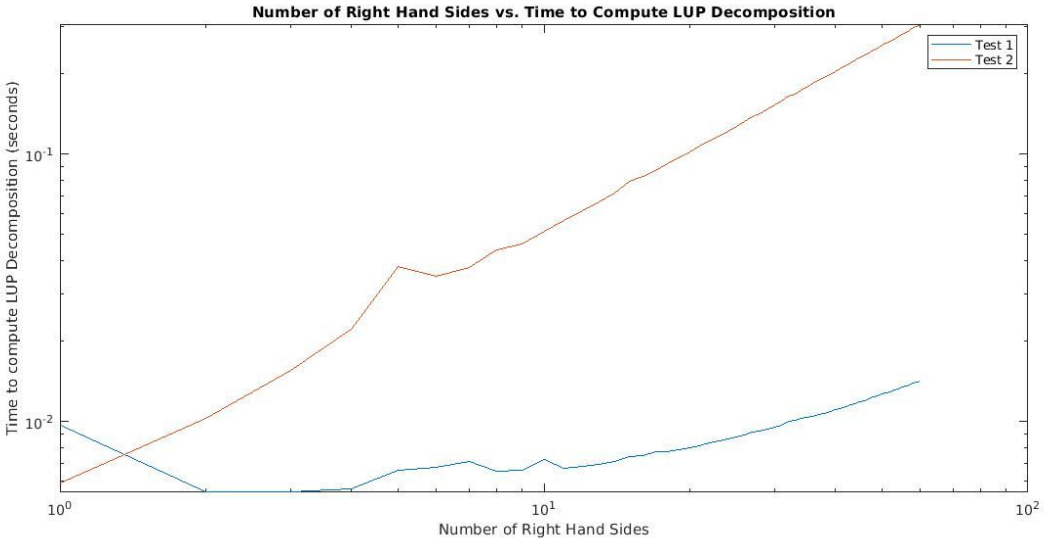
CS 3200

LUP Decomposition Analysis



The following responses to question 2 use this graph for analyzing timing.
2a) For the first timing test which tested doing LUP decomposition once, followed by n number of backsubs based on the number of right hand side vectors generated, the experiment yielded the blue trendline. The slope is roughly 2 which reflects the cost of doing n number of backsub calculations based on n number of right hand sides. The complexity cost for doing backsub and forward sub is O(N^2) which is reflected by the blue trendline.

2b) For the second timing test which tested doing LUP decomposition n times, followed by n number number of backsubs based on the number of right hand side vectors generated, the experiment yielded the orange trendline. The slope is roughly 3 which reflects the domination of the cost to do LUP decomposition which is O(N^3) over the cost of solving the linear system using backsub which is O(N^2). Thus the second experiment is more costly than the first because we are calling LUP decomposition as many times as there are number of right hand sides. From a cost analysis viewpoint, if we do not know the number of right hand sides ahead ahead of time, it would be better to LUP decomposition once, to store the row operations and then use the stored operations once to solve the right hands sides which would cause the cost to be O(N^2) based on using either backsub or forward sub to solve the linear system. If we already have the right hand sides ahead of time, then we wouldn't need LUP decomposition and instead use Gaussian elimination.