Benjamin Sarol

Dr. Andrew Mertz

CSM 3980 Parallel Programming

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Homework 1.

Machine Specifications:

- 8 Cores / 16 Logical Processors
- 3.6 Ghz base speed/ up to 4.2 Ghz
- 16gb Memory

Hypothesis:

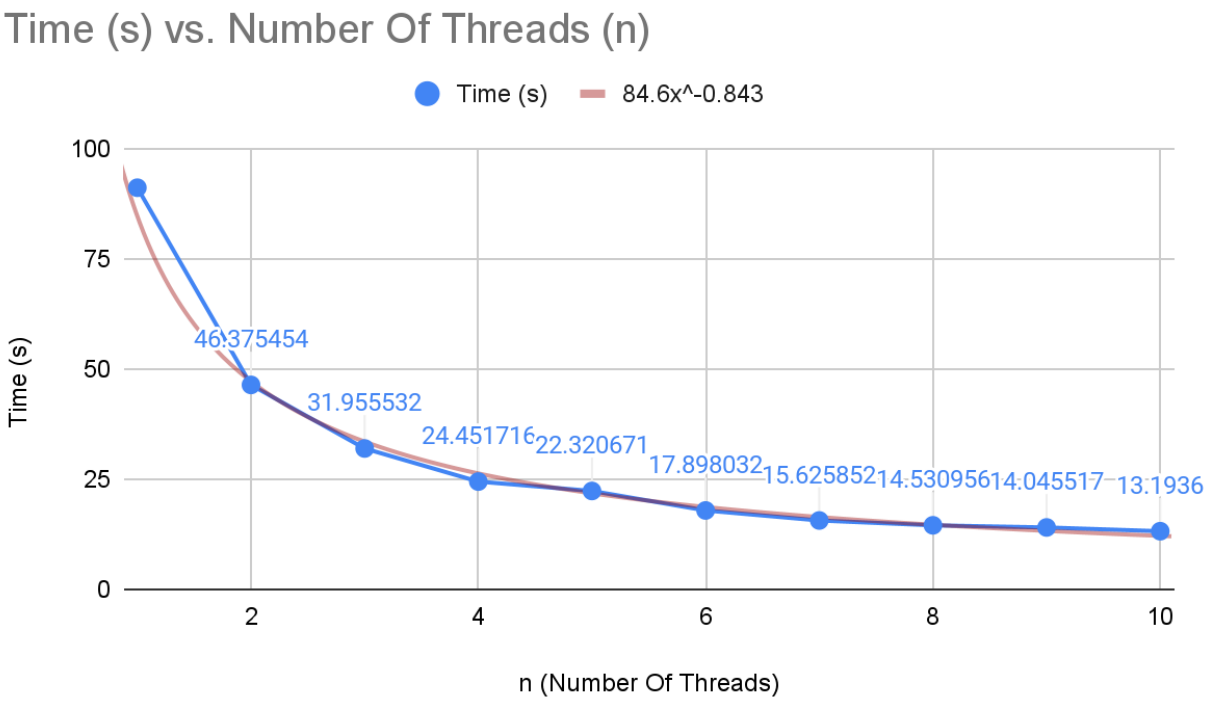
Row Stride, block Stride, and pixel stride will each equally take the same time to run since each thread is given specified pixels to work on prior to running. Their "next free" counterparts will be slower, especially pixel stride since the continuous access to a list to determine the next available pixel to work on. The next free block model will be faster than the next free row and next free pixel model of distribution since it requires the least amount of access to the synchronized list to start computing the noise values.

In the case that time it takes to process are not similar across the board, the growth trend throughout should still be similar since it is embarrassingly parallel. The growth rate will be exponential with a growth factor of 0.5 for each number of threads added for all methods of distribution.

Note: All images are processed first before an image is shown on screen. Meaning only the last image processed will be shown on the screen. For all tests, I will be using an image size of 500 by 500 pixels. **Block Size = 10. I used i = 3000**

Row Stride

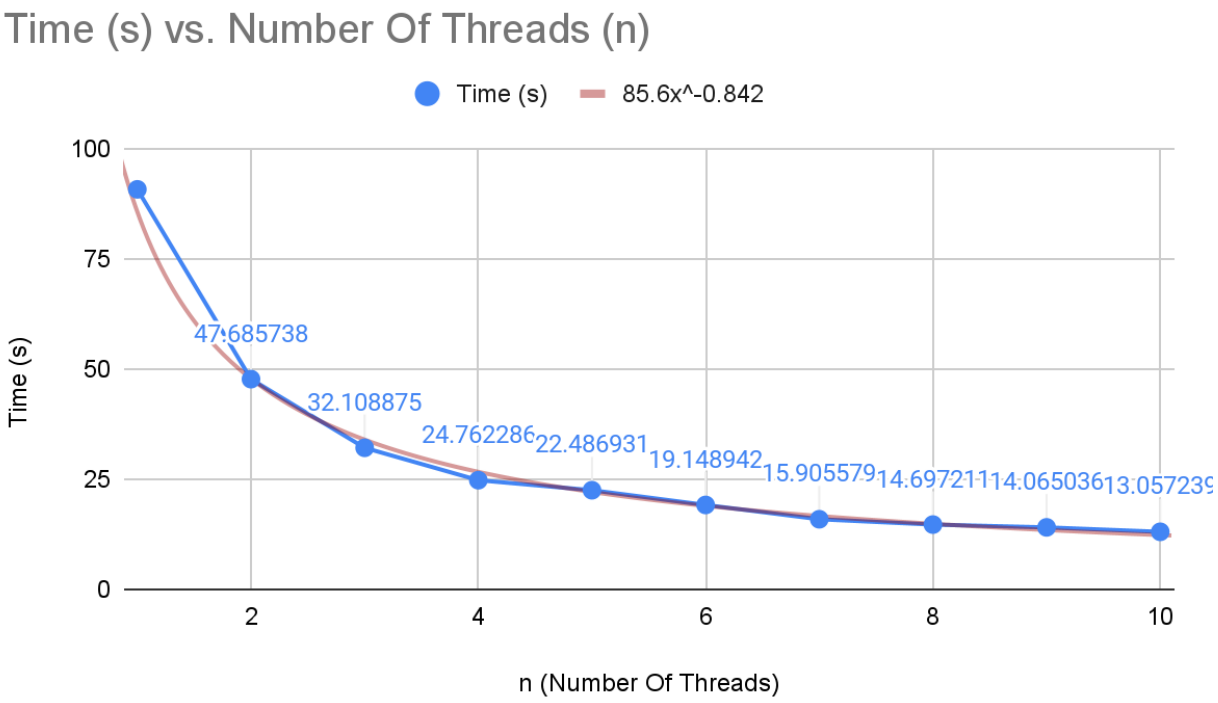
Images Per Test: 3000



The graph seems to follow a power trendline with the equation shown above with a = 84.6 and b = -0.843. This refutes my hypothesis of exponential growth. The next distribution model also shows similar trends. This is for i = 3000.

Block Stride

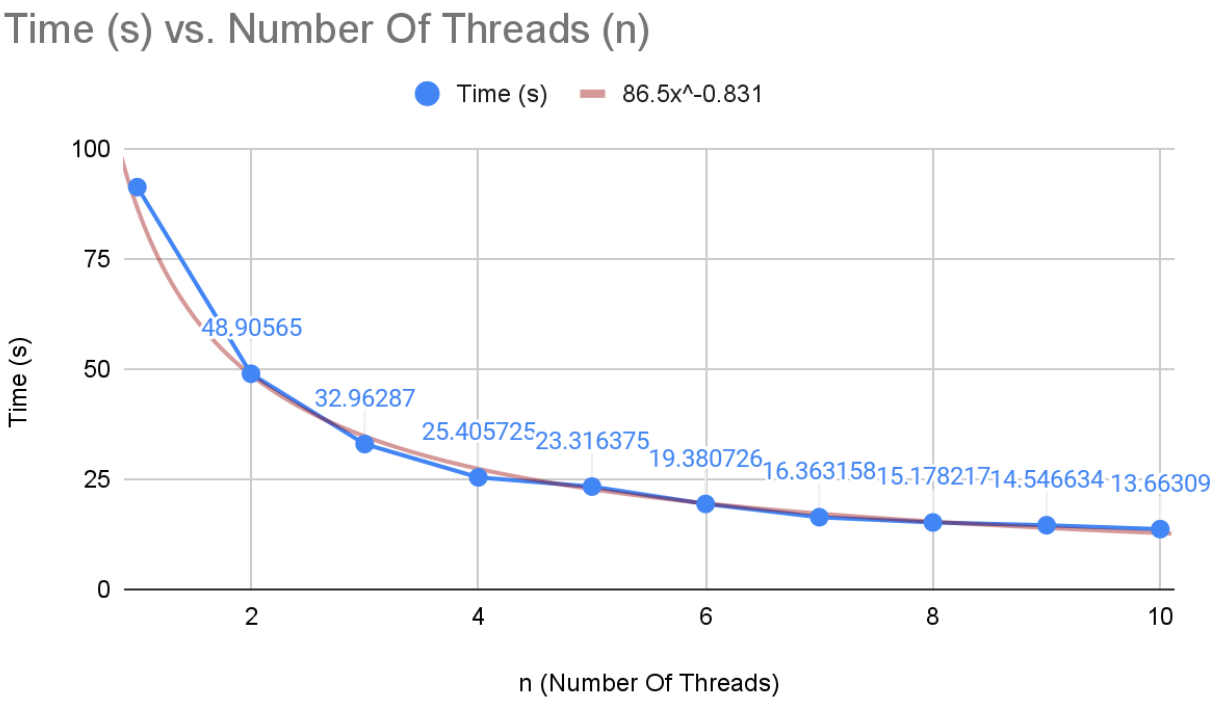
Images Per Test: 3000



Again for i = 3000, there is a similar power trendline with almost identical values of a and b. This model also refutes the hypothesis of exponential decay trend, however it fails to reject the hypothesis that row stride and block stride follow the same growth trend.

Pixel Stride

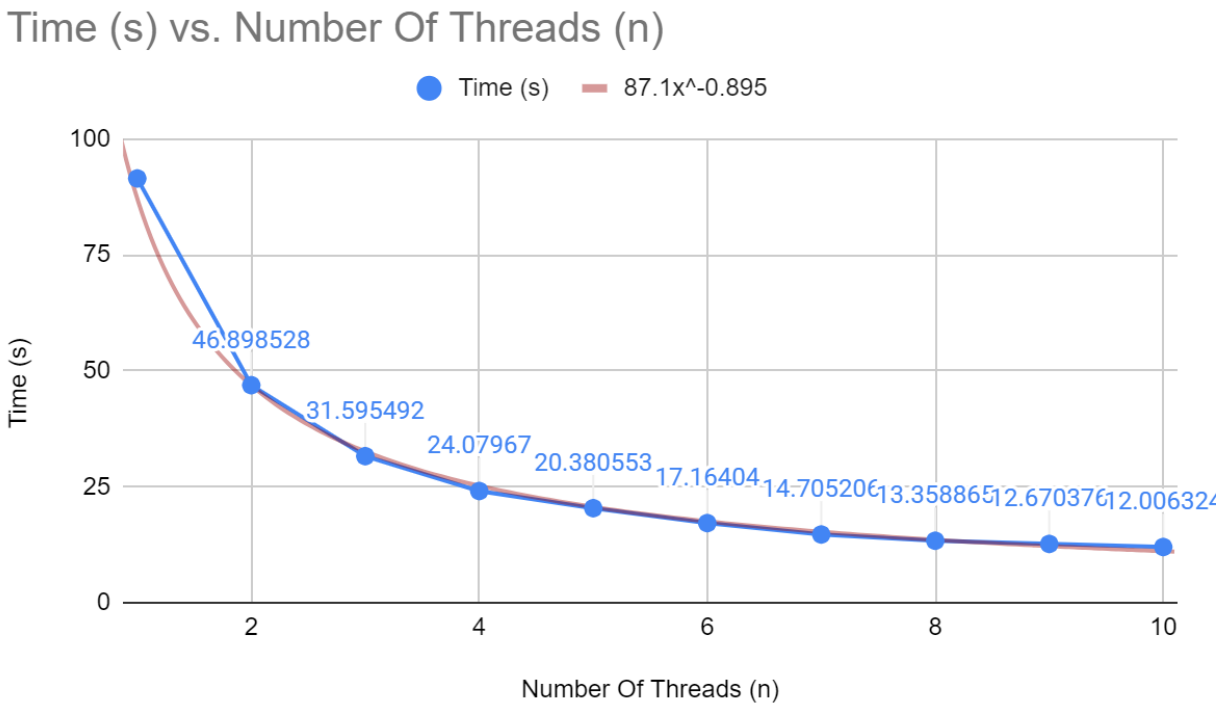
Images Per Test: 3000



Again I have tested for i = 3000. This again fails to refute the hypothesis that the first 3 takes the same or similar amount of time to compute images. It does however show a slight increase in the amount of time to process images, in second/milliseconds. I suspect it is due to the conversion from pixel to row/column to coordinates. It follows

Next Free Row

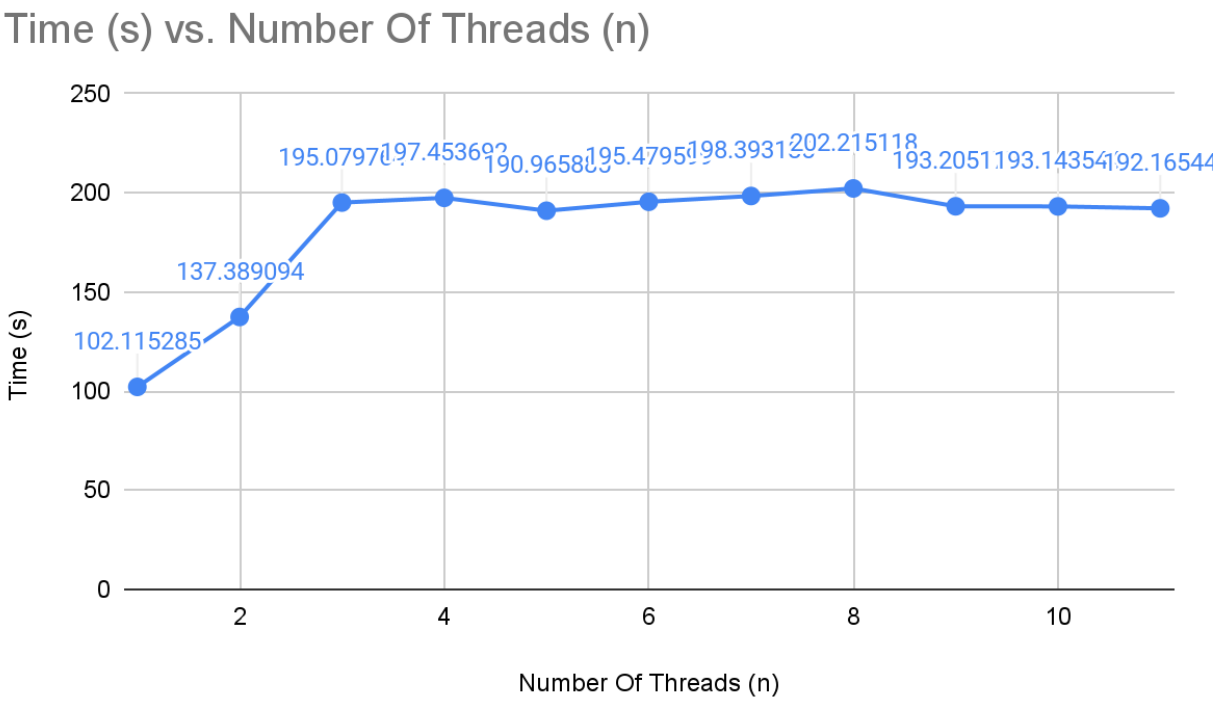
Images Per Test: 3000



Since each test processes i = 3000 images, the time it took to process for one thread is significantly faster than the first 3 previous methods of distribution. This refutes the hypothesis that the "next free available" models of distributions would take a longer amount of time. In fact, there is a slight decrease in the amount of time it took to process each image as the number of threads increases. This also fails to reject the hypothesis that the growth trend will be similar to the rest of the models. The only exception is the next model of distribution.

Next Free Pixel

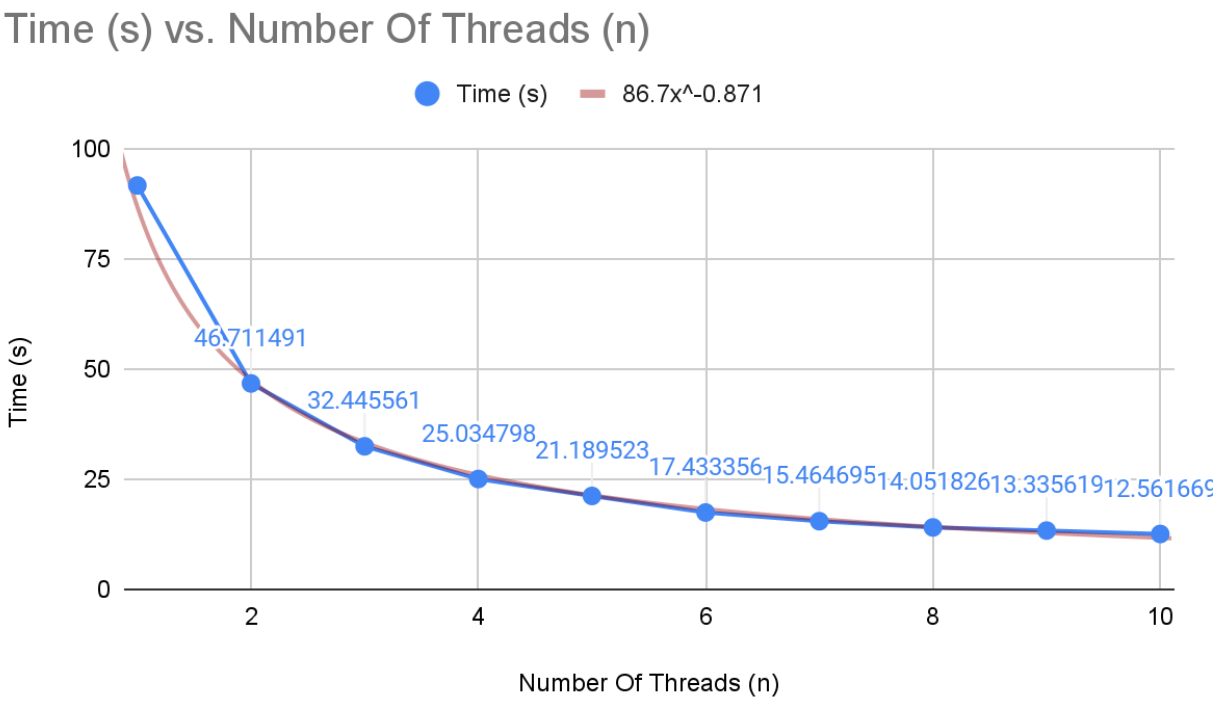
Images Per Test: 3000



This model fails to refute the hypothesis that the next free pixel model will take longer than all other models. It does reject that it would follow an exponential decay growth trend and also the same or similar growth trend as all the other models. I suspect that this is due to the bottleneck in the amount of time it takes to compute the noise for each pixel and also the number of threads accessing the list. Since it is quick to compute the noise for each pixel, the thread will quickly attempt to access the synchronized list again. This leads to a long queue to access the list.

Next Free Block:

Images Per Test: 3000



Again this follows a similar trend to the first 4 models. The amount of time to process each image for higher thread count is faster than the first 3 models of computation which does not rely on a synchronized list.

Most of these models follow a similar trend except for the next free pixel model. Again this is due to the next row model and next block model requiring less amount of access to the synchronized list. Although it was expected the rest would follow a similar growth trend, it was unexpected that they would take a similar amount of time to process the images.