# ECE 60827 Programming Assignment 1

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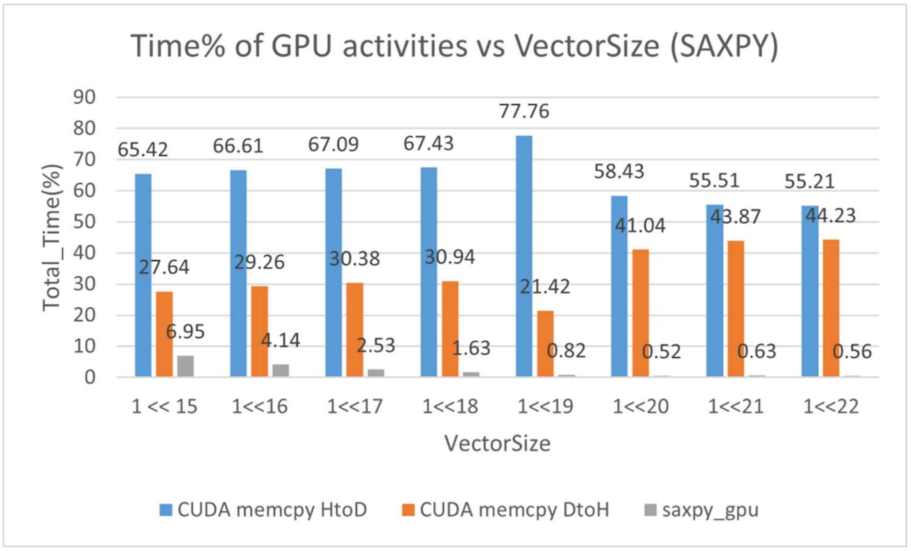
## Part – A (SAXPY)

In the part A, after executing the SAXPY code on the GPU, we will be comparing it's Total_time(%) of different GPU activities like cudamemcpy Host To Device , cudamemcpy Device To Host and saxpy_gpu and different API activities like cudaMalloc and cudaLaunchKernal by varying the Vector size.

**Key terms:**

1) CUDA memcpy HtoD = cudamemcpy Host to Device
2) CUDA memcpy DtoH = cudamemcpy Device to Host

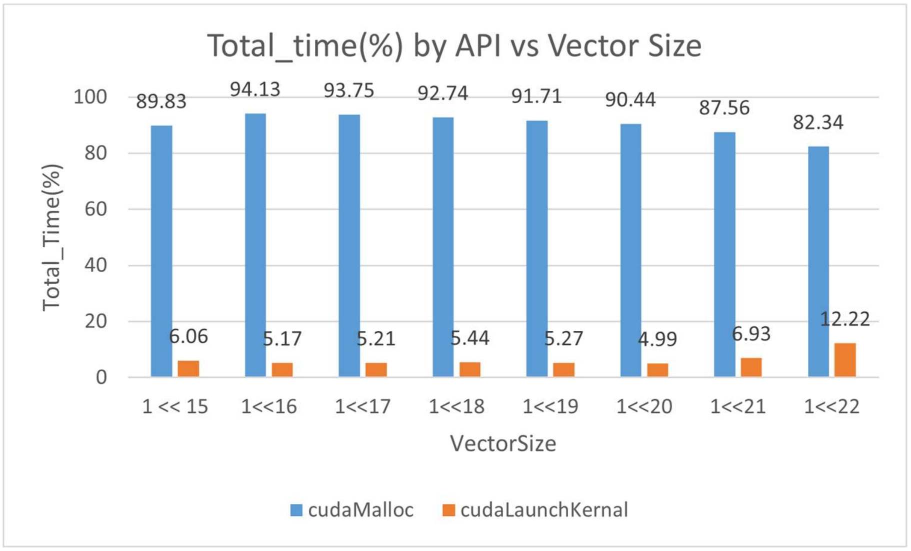
**GPU Activities:**



**Observation:**

From the above graph, it is evident that as the VectorSize goes from 1<<15 to 1<<19, the cudamemcpy Host to Device will be consuming a major potion of time and it increases with size (maximum at 1<<19) and cudamemcpy Device to Host is the 2nd largest in Total_Time (%) and it also increases with VectorSize (for cudamemcpy Device to Host upto 1<<18). But from 1<<20 to 1<<22, it is evident that the (%) Total_Time stacks of cudamemcpy Host to Device decreases (although it is the largest (Total_Time%)) and cudamemcpy Device to Host increases in Total_Time(%). When it comes to saxpy_gpu it's Total_Time(%) decreases with increases in vectorsize although it has a slight fluctuation in between 1<<20 and 1<<22.

**API Activities:**



**Observation:**

Now, this graph describes about the Total_time(%) taken by API activities with increase in Vector Size. From the graph, it is evident that cudaMalloc is the largest (%) and the next is cudaLaunchKernal. Although cudaMalloc is the largest Total_time(%), it gets fluctuated in the mean time and has the highest at 1<<16 i.e. 94.13% and similarly for the cudaLaunchKernal which gets it’s highest value at 1<<22.

# Part -2 Using Monte Carlo to get the value of Pi:

Here, too after executing the code to achieve the value of Pi, we will be comparing it's  Total_time(%) of different GPU activities like cudamemcpy Host To Device , cudamemcpy Device To Host and saxpy_gpu and different API activities like cudaMalloc and cudaLaunchKernal by varying the samplesize, GenerateThreads and reduceSize.

**Key Terms:**

1) samplesize = sampleSize

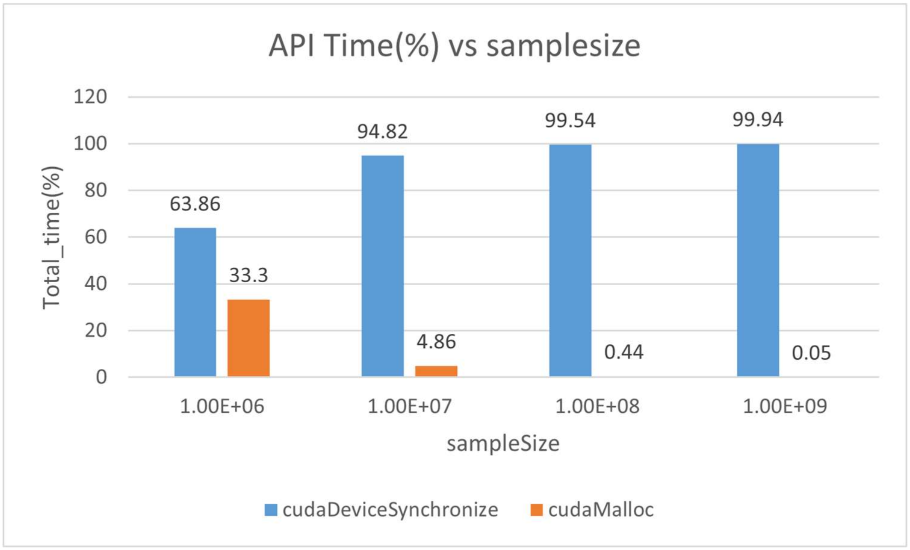
## i) By Varying sampleSize:

Here the performance is compared with the varying sampleSize by keeping the values of reduceSize and Generate Thread as constant.

### GPU Activities:

When it comes to GPU activities like generatePoints, reduceCounts and [CUDA memcpy DtoH], the Total_time(%) of reduceCounts and [CUDA memcpy DtoH] are negligible when compared with the Total_time (%) of generatePoints. Like the generatePoints is in the milli seconds to seconds as the sampleSize increases and the rest two activities are in the microseconds. Majority or equal to 100% will be of generatePoints.

### API Activities:



### Observation:

Although there are many API activities like cudaDeviceSynchronize, cudaMalloc, cudaFree, cudaLaunchKernal etc, cudaDeviceSynchronize and cudaMalloc are the most prominent ones, as their Total_time(%) is nearly approximately above 97%. From the above graph it is evident that as the sampleSize increases the Total_time(%) of cudaDeviceSynchronize increases and cudaMalloc's Total_time(%) decreases. There is a drastic increase in the Total_time(%) of cudaDeviceSynchronize from 1E6 to 1E7 and similarly a drastic decrease for cudaMalloc. **I think the reason for high**

**percentages for cudaDeviceSynchronize is like I might have used it many times, so it might have dominated other API Total_time percentages.** It is also evident as the sampleSize increases, it too got increased.

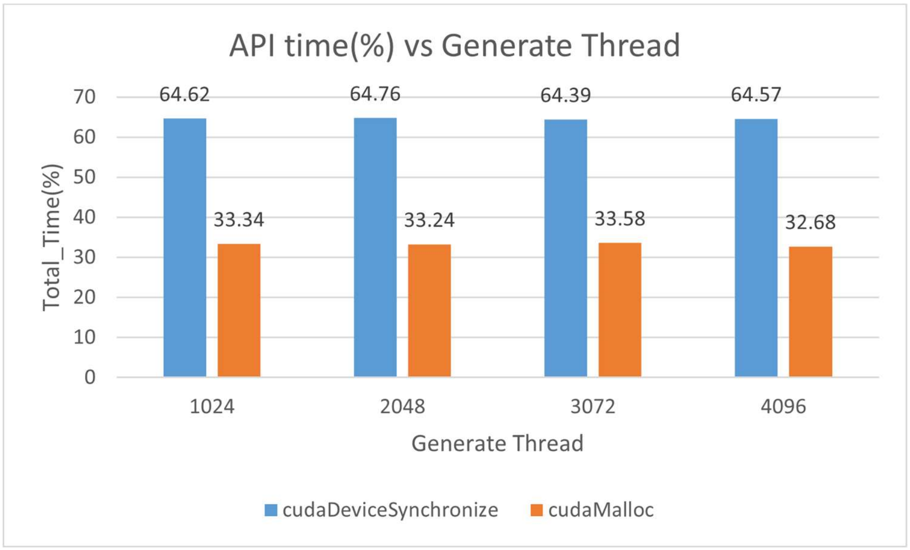
## ii) By Varying the Generate Thread:

Here the performance is compared with the varying of Generate Thread by keeping the values of reduceSize and sampleSize as constant.

### GPU Activities:

When it comes to GPU activities like generatePoints, reduceCounts and [CUDA memcpy DtoH], the Total_time(%) of reduceCounts and [CUDA memcpy DtoH] are negligible when compared with the Total_time (%) of generatePoints. Like the generatePoints is in the milli seconds to seconds as the sampleSize increases and the rest two activities are in the microseconds. Majority or equal to 100% will be of generatePoints.

### API Activities:



### Observation:

Although there are many API activities like cudaDeviceSynchronize, cudaMalloc, cudaFree, cudaLaunchKernal etc, cudaDeviceSynchronize and cudaMalloc are the most prominent ones, as their Total_time(%) is nearly approximately above 98%. From the above graph it is evident that as the Generate Thread increases from 1024 to 4096, the cudaDeviceSynchronize and cudaMalloc functions stays at the relatively same value ( although small percentage changes) of Total_Time(%). There are no much evident changes among them. **I think the reason for high percentages for cudaDeviceSynchronize is like I might have used it many times, so it might have dominated other API Total_time percentages.**

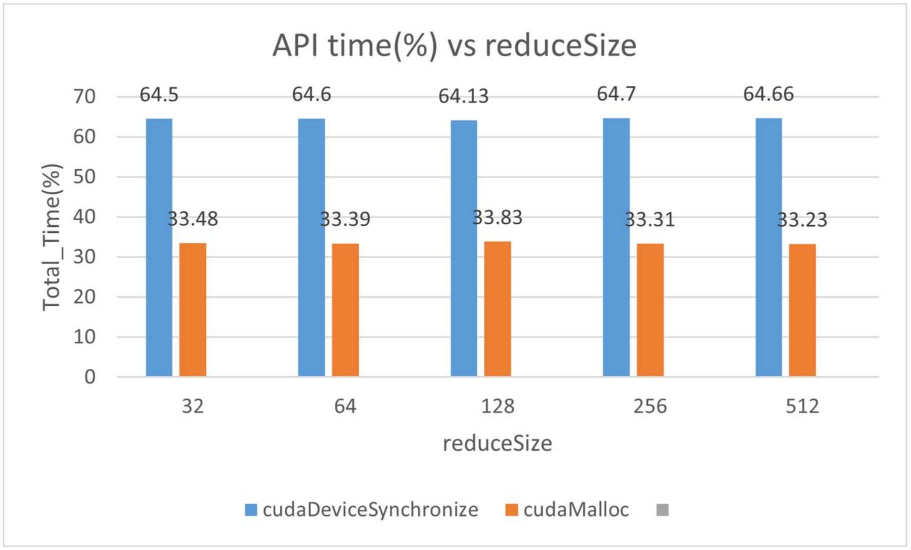
## iii) By Varying the reduceSize:

Here the performance is compared with the varying of reduceSize by keeping the values of Generate Thread and sampleSize as constant.

### GPU Activities:

When it comes to GPU activities like generatePoints, reduceCounts and [CUDA memcpy DtoH], the Total_time(%) of reduceCounts and [CUDA memcpy DtoH] are negligible when compared with the Total_time (%) of generatePoints. Like the generatePoints is in the milli seconds to seconds as the sampleSize increases and the rest two activities are in the microseconds. Majority or equal to 100% will be of generatePoints. **There is a slight change of reduceCounts as it contributes 0.01% of Total_Time when the reduceSize is 512 and for other sizes it is approximately zero.**

### API Activities:



### Observation:

Although there are many API activities like cudaDeviceSynchronize, cudaMalloc, cudaFree, cudaLaunchKernal etc, cudaDeviceSynchronize and cudaMalloc are the most prominent ones, as their Total_time(%) is nearly approximately above 98%. From the above graph it is evident that as the reduceSize increases from 32 to 512, the cudaDeviceSynchronize and cudaMalloc functions stays at the relatively same value ( although small percentage changes) of Total_Time(%). There are no much evident changes among them. **I think the reason for high percentages for cudaDeviceSynchronize is like I might have used it many times, so it might have dominated other API Total_time percentages.**