

MECE 5397/6397

## Assignment 8AA

Due Tuesday, April 23<sup>rd</sup> in class

1. A hard drive has the following properties: Rotational rate = 10,000 RPM, Average seek time = 4 ms., Avg # sectors/track = 800, 1024 Bytes/sector. Find the total access time to read 32KB of data (1KB=1024 Bytes) from one surface of a hard drive.
2. Compare 70% cache hit rate with 31% cache miss rate
3. Fortran programming language uses column major ordering to store arrays. If I have a large 2D array in Fortran with individual dimensions of array exceeding the cache memory size, what would be the cache miss rate when traversing along a column and when traversing along a row (assume single cache memory level).
4. Optimize the following MATLAB matrix multiplication code,

```
for i=1:N
    for j=1:N
        for k=1:N
            c(i,j) = a(i,k) * b(k,j);
        end
    end
end
```

5. Run the memory mountain code on your system and create the corresponding surface plot.  
git clone <https://github.com/fabiensanglard/CpuCacheMountainViewer.git>  
gcc -Wall -o mountain mountain.c fcyc2.c clock.c  
./mountain  
You could use the ECC machine if you don't have access to any other system with c compiler.
6. Write you own matrix multiplication code and recreate the graph from the "Core i7 Matrix Multiply Performance" slide.

7. One obvious way to transpose a matrix is to use,

```
for i=1:n
    for j=1:n
        destination(j+i*n) = source(i+j*n);
    end
end
```

How can you take advantage of locality and cache blocking to improve the performance of this operation?