Quiz 2

- **Q1**: Given a HPC system with 4096 nodes. Calculate bisection, total number of links, Diameter if nodes connected using

  a) Hypercube Network **: Bisection: N/2= 2048, Total Number of link= N*lgN / 2 = 4096*12/2=24,576; Diameter = lgN=12**

  b) 3D Mesh arrange using 16x16x16 grid: Bisection: 16x16= 256, Total Number of link≈N*6/2-16*16*6/2=11520; Diameter = 16X3=48

- Q2: Given an app with serial fraction 0.1, calculate

  a) Maximum achievable speed up: **1/s = 1/0.1=10**

  b) Efficiency if 12 processors are used:

  Sp= 1/ (0.1+0.9/12) =1/0.175 =5.714

  Efficiency=Sp/P= 5.714/12=0.476166

Quiz 2

- Q3: Analyze the code for T_1, T_∞ and Parallelism

```
cilk int MapReduce(float  *A, int n){
   if (n<=sqrt(N)){for(i=0; i<n; i++) S=S+Map(A[i]);
   } else {
     S1= spawn MapReduce (A, n/2);
     S2= spawn MapReduce (A+n/2, n-n/2);
     sync;
     S=S1+S2;
   } //Map(A[i])and sqrt(N) takes  O(1) time
}    // N is length of array A
```

$T_1(n) = 2*T(n/2)+1$ if n>sqrt(N) ➔ **O(N)**

$T_1(n) = O(n)$ if n<sqrt(N) ➔ O(N)

$T_\infty(n)=T_\infty(n)+1$ if n>sqrt(N) $T_\infty(n) =O(n)$ if n<sqrt(N)

$T_\infty(n) = \lg N - \lg(\sqrt{N}) + \sqrt{N} = \lg(N/\sqrt{N}) + \sqrt{N}$ **= lg ($\sqrt{N}$) + $\sqrt{N}$**

$= \frac{1}{2}* \ln N + \sqrt{N}$

Parallelism= O(n)/ [lg ($\sqrt{N}$) + $\sqrt{N}$] or O(n)/ [½* ln N + $\sqrt{N}$]

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Example N=1024, division goes upto 32, once it reach 32 it do serially, So   Span is 5+32

```
1024->512+512
512->256+256
256->128+128
128->64+64
64->32+32
```

$(\lg N - \lg \sqrt{N}) + \sqrt{N}$

$(\lg 1024 - \lg 32) + 32$

$(\lg \sqrt{N}) + \sqrt{N}$