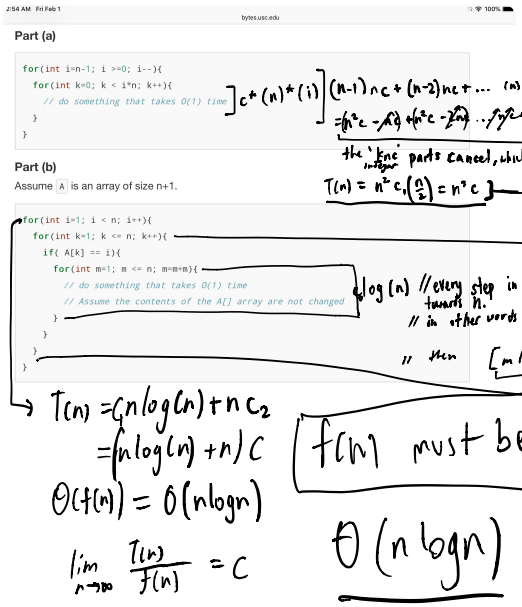


$c + (n)*(i)$ $\Big] (n-1)nc + (n-2)nc + \dots (n)c + 0$

$= n^2 c - \cancel{nc} + n^2 c - \cancel{2nc} \dots \cancel{n^2 c} + 0$

the 'linear' parts cancel, which leaves:

$T(n) = n^2 c_1 \left(\frac{n}{2}\right) = n^2 c$

→ f(n) must be n^2 for $\theta(f(n))$ in order for $\lim_{n\to\infty} \frac{T(n)}{f(n)} = c$

$= \theta(n^2)$

$\log(n)$ // every step in a way "halves" the distance towards n.
// in other words [m / m]
// then [m / m]
n

this takes log(n) steps

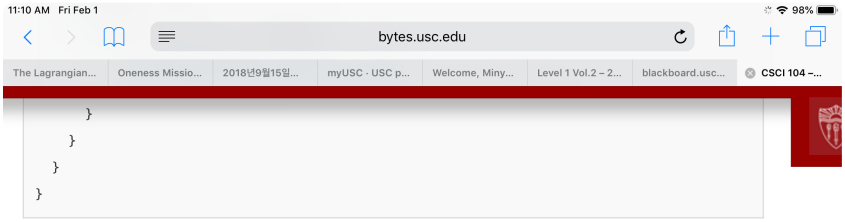
$C_1 \log(n) + C_2$

if runs c. when it's true, it runs the log(n) for

$T(n) = (n\log(n) + n)c_2$
$= (n\log(n) + n)C$
$\theta(f(n)) = \theta(n\log n)$
$\lim_{n\to\infty} \frac{T(n)}{f(n)} = C$

f(n) must be $n \log(n)$

$\theta(n \log n)$



Part (c)

```
void f3(int* A, int n)
{
  if(n <= 1) return;
  else {
    f3(A, n-2);
    // do something that takes O(1) time
    f3(A, n-2);
  }
}
```

$f3(A,n) = f3(A,n-2) + f3(A,n-2) + C$

$= 2f3(A,n-2) + C_1$

$= 2(f3(A,n-4) + f3(A,n-4) + C_2) + C_1$

$= 4f3(A,n-4) + C_3$

$\frac{n}{2}$ steps

$\vdots$

$K f3(A,1) + C_4$

Part (d)

Notice that this code is somewhat similar to what happens if you keep inserting into a vector.

$T(n) = C_5 * \left(\frac{n}{2}\right) = Cn$

$f(n) = n$

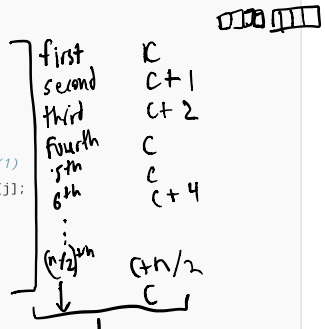
for $\lim_{x\to\infty} \frac{T(n)}{f(n)} = C$

$\theta(n)$

Part (d)

Notice that this code is somewhat similar to what happens if you keep inserting into a vector.

```
int *a = new int [10]; // new is O(1)
int size = 10;
for (int i = 0; i < n; i ++)
  {
    if (i == size)
      {
        int newsize = 3*size/2;
        int *b = new int [newsize];  // new is O(1)
        for (int j = 0; j < size; j ++) b[j] = a[j];
        delete [] a;  // delete is O(1)
        a = b;
        size = newsize;
      }
    a[i] = i*i;
  }
```



$Cn + \frac{n}{2} + n/4 + n/8 \cdots 2 + 1 = Cn = T(n)$

f(n) must be for $\lim_{n \to \infty} \frac{T(n)}{f(n)} = \frac{Cn}{n} = C$

$\Theta(n)$

Problem 5 (Linked Lists, Recursion, 10%)

Consider the following C++ code. What linked list is returned if funcA is called with the input