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Scientific Computing - Homeworks

2.22 Verify that the dominant term in the operation count (number of multiplications or number of additions) for LU factorization of a matrix of order n by Gaussian elimination is $n^3/3$.

For a matrix of order n , with Gaussian LU factorization will have :

```
for  k = 1 .. n-1
     for  i = (k+1) .. n
          operation 1
          for j = (k+1) .. n
               operation 2
          end
      end
end
```

$O(LU) = \sum k=1:(n-1) * [\sum i=k:n * (1 + \sum j=k+1:n)]$
$= \sum k=1:(n-1) * [(n-k) * (1 + (n-k))]$
$= (n-1) * (n + n^2) - (2n+1)n(n-1)/2 + (2n-1)n(n-1)/6$
$= n^2 + n^3 – n – n^2 - n^3 + n^2 - n^2/2 + n/2 + n^3/3 - n^2/3 - n^2/6 + n/6$
$= n^3/3 – n/3$