Statistics 243: *class notes*

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1 Matrix Multiplication

The i,jth element is the dot product of the ith row of the first matrix with the jth col of the second matrix. To matrix multiply A and B, nrowa is the stride for matrix A, while 1 is the stride for B. So the i,jth element is

```
dots(a+i, b+(j*nrowb),ncola,nrowa,1)
```

Recall

```
dots(double *a, double *b, long n, long ix, long iy)
= dots(A, B, inner dimension, stride for A, stride for B)
```

To do the matrix multiplication $A^t B$, the ijth element is

```
dots(a+(i*nrowa), b+(j*nrowb),nrowa, 1,1)
```

Now consider the problem of multiplying $X^t X$.

$$
\begin{aligned}
(X^t X)_{ij} &= \sum_{k=1}^{n} (X^t)_{ik} X_{kj} \\
&= \sum_{k=1}^{n} X_{ki} X_{kj}
\end{aligned}
$$

The last line is the dot product of the ith col and the jth col.

```
for(i=0;i<p;i++)
  for(j=0;j<=i,j++)
```

$\qquad X^t X_{ij} = $ dot product of (col i of X and col j of X)