**Multidimensional Gaussian integral**

This report focuses on calculating integrals related to the following Gaussian function:

Note, ***x*** = (*x*1, *x*2,…, *xh*)*T* is *h*x1 vector, *A* is *n*x*h* matrix, *B* is *m*x*h* matrix, and *c* is *h*x1 vector whereas *R* is *n*x*n* matrix and *S* is *m*x*m* matrix. Moreover, *R* and *S* are invertible and positive definite. Firstly, we calculate the integral of *f*(*x*).

Diagonalizing *R* and *S* as follows:

We have

Where

Let *w* be the maximum value among *n*, *m*, and *h* and let

We obtain:

As a convenience, let

Therefore, we have:

Let

We have:

Where Δ is eigenmatrix of *B*–1*A*. This implies: