**1.** Suppose  $X_1, \ldots, X_n$  is a random sample from

$$\left(\begin{array}{c} Y\\ Z\end{array}\right) \sim N_2\left(\left(\begin{array}{c} 0\\ 0\end{array}\right), \left(\begin{array}{c} \sigma_1^2 & 0\\ 0 & \sigma_2^2\end{array}\right)\right)$$

Let  $r_{yz}$  denote the sample correlation coefficient of Y and Z computed from this random sample. Derive the distribution of

$$\frac{r_{yz}^2}{1 - r_{yz}^2}$$

(*Hint:* You may use the following result from Problem 5 of Hw4: The statistic  $\frac{|S|}{|S_{11}|\cdot|S_{22}|}$  has the distribution of a product of p-r independent beta-distributed random variables with parameters  $(\frac{n-p+1}{2}, \frac{r}{2}), (\frac{n-p+2}{2}, \frac{r}{2}), \ldots, (\frac{n-r}{2}, \frac{r}{2})$ , respectively.)

- 2. Suppose  $S \sim W_p(n, \Sigma)$ , the Wishart distribution with *n* degrees of freedom and  $p \times p$  covariance matrix  $\Sigma$ . Derive the distribution of trace $(S\Sigma^{-1})$ .
- 3. Justify (6-70) on page 317.
  (*Hint:* You may follow the same procedure deriving Result 6.5 on page 309.)