We want to determine the sample size for the following problem: Suppose $Y$ is $N_4(\mu, \Sigma)$. We are testing

$$H_0: \ A\mu = 0 \text{ versus } H_A: \ A\mu \neq 0,$$

where

$$A = \begin{bmatrix} 1 & -1 & 0 & 0 \\ 1 & 0 & -1 & 0 \\ 1 & 0 & 0 & -1 \end{bmatrix}.$$

Obtain the sample size so that the power of the Hotelling's $T^2$ test ($F$-version) has power 0.90 to detect the mean $\mu' = (0.00, 0.33, 0.67, 1.00)$. Actually, obtain a table of sample sizes and powers.

You can use the ten observations of the pilot study from the link pilot. Also, $pf(x, df1, df2, ncp)$ obtains $P(W \leq x)$ where $W$ has a $F(df1, df2)$-distribution with noncentrality parameter $nc$. 

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