Stat 8311, Singular Value Decomposition in R

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  Natural language support but running in an English locale

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'help.start()' for a HTML browser interface to help.
Type 'q()' to quit R.

[Previously saved workspace restored]

> invisible(options(echo = TRUE))
> set.seed(121)
> options(digits=4)
> a <- matrix(rnorm(15),ncol=3)
> a
         [,1]     [,2]    [,3]
[1,] -0.25536  1.61533  1.4028
[2,]  0.10837  0.29727 -0.8615
[3,]  0.12778 -0.05765 -0.4009
[4,] -0.08107 -1.09961 -0.5660
[5,] -0.71368  0.91355  0.5447
> #------------------------------------------------------------
> d<- svd(a)
> d
$d
[1] 2.7502 0.9518 0.6100

$u
        [,1]     [,2]     [,3]
[1,] -0.7817 -0.04652  0.22650
[2,]  0.1207  0.89829 -0.05102
[3,]  0.1154  0.29259  0.07524
[4,]  0.4270 -0.30292 -0.44457
[5,] -0.4228  0.11640 -0.86186

$v
        [,1]     [,2]    [,3]
[1,]  0.1798  0.09257 0.97933
[2,] -0.7597  0.64556 0.07847
[3,] -0.6250 -0.75808 0.18641

> #------------------------------------------------------------
> round(d$u %*% diag(d$d) %*% t(d$v) - a,3)
```

```
     [,1] [,2] [,3]
[1,]    0    0    0
[2,]    0    0    0
[3,]    0    0    0
[4,]    0    0    0
[5,]    0    0    0
> #------------------------------------------------------------
> d$dˆ2
[1] 7.5635 0.9059 0.3721
> eigen(t(a) %*% a)
$values
[1] 7.5635 0.9059 0.3721

$vectors
        [,1]     [,2]    [,3]
[1,]  0.1798 -0.09257 0.97933
[2,] -0.7597 -0.64556 0.07847
[3,] -0.6250  0.75808 0.18641

> eigen(a %*% t(a))
$values
[1]  7.563e+00  9.059e-01  3.721e-01  2.191e-16 -1.128e-15

$vectors
        [,1]     [,2]     [,3]     [,4]    [,5]
[1,]  0.7817 -0.04652  0.22650 -0.22536 -0.5336
[2,] -0.1207  0.89829 -0.05102  0.20753 -0.3645
[3,] -0.1154  0.29259  0.07524 -0.91900  0.2255
[4,] -0.4270 -0.30292 -0.44457 -0.24698 -0.6835
[5,]  0.4228  0.11640 -0.86186 -0.02433  0.2536

> #------------------------------------------------------------
> P <- d$u %*% t(d$u)
> P
         [,1]     [,2]     [,3]     [,4]     [,5]
[1,]  0.66446 -0.14772 -0.08675 -0.42041  0.12985
[2,] -0.14772  0.82410  0.27292 -0.19787  0.09748
[3,] -0.08675  0.27292  0.10458 -0.07281 -0.07956
[4,] -0.42041 -0.19787 -0.07281  0.47177  0.16735
[5,]  0.12985  0.09748 -0.07956  0.16735  0.93509
> sum(diag(P))
[1] 3
> eigen(P)$values
[1]  1.000e+00  1.000e-00  1.000e-00  5.850e-17 -2.457e-16
> round((diag(rep(1,5))-P) %*% a, 2)
     [,1] [,2] [,3]
[1,]    0    0    0
[2,]    0    0    0
[3,]    0    0    0
[4,]    0    0    0
[5,]    0    0    0
> q(save="no")
```