

How to fix system is exactly singular in R?

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The statement "Is the system in R exactly singular if we fix it?" refers to the determination of whether a system in R, a mathematical set of equations, is exactly singular when a specific solution or value is fixed. This question is asking if the system has a unique solution or if it has an infinite number of solutions. The answer to this question is important in understanding the behavior and properties of the system, as well as determining the appropriate methods for solving it.

Fix in R: system is exactly singular

One error you may encounter in R is:

Lapack routine dgesv: system is exactly singular: U = 0

This error occurs when you attempt to use the `solve()` function, but the matrix you're working with is a singular matrix that does not have a matrix inverse.

This tutorial shares how to resolve this error in practice.

How to Reproduce the Error

Suppose we create the following matrix in R:

```
#create singular matrix
```

```
mat <- matrix(c(1, 1, 1, 1), ncol=2, nrow=2)
```

```
#view matrix
```

```
mat
```

```
1 1
```

1 1

Now suppose we attempt to use the `solve()` function to calculate the matrix inverse:

```
#attempt to invert matrix  
solve(mat)
```

Error in `solve.default(mat)` :

Lapack routine `dgesv`: system is exactly singular: $U = 0$

We receive an error because the matrix that we created does not have an inverse matrix.

Note: Check out from Wolfram MathWorld that shows 10 different examples of matrices that have no inverse matrix.

By definition, a matrix is singular if it has a determinant of zero.

You can use the `det()` function to calculate the determinant of a given matrix before you attempt to invert it:

```
#calculate determinant of matrix  
det(mat)
```

```
0
```

The determinant of our matrix is zero, which explains why we run into an error.

How to Fix the Error

The only way to fix this error is to simply create a matrix that is not singular.

```
#create matrix that is not singular  
mat <- matrix(c(1, 7, 4, 2), ncol=2, nrow=2)
```

```
#view matrix  
mat
```

```
1 4
```

```
7 2
```

```
#calculate determinant of matrix  
det(mat)
```

```
-26
```

```
#invert matrix
```

```
solve(mat)
```

```
-0.07692308 0.15384615
```

```
0.26923077 -0.03846154
```

We don't receive any error when inverting the matrix because the matrix is not singular.

Additional Resources

The following tutorials explain how to fix other common errors in R: