

# Re: Maximizing the trace

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*Source:* <http://sci.tech-archive.net/Archive/sci.math/2005-04/msg01399.html>

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- *From:* [lrudolph@xxxxxxxxxx](mailto:lrudolph@xxxxxxxxxx) (Lee Rudolph)
  - *Date:* 9 Apr 2005 20:28:27 -0400
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garrettbaird2@xxxxxxxxxx writes:

>Hello,  
>Can anybody tell me what orthogonal matrices have maximum trace? It's  
>the last part in a series of problems for me which I cannot figure out.  
> We are given as a hint the Cayley parametrization, which says that any  
>orthogonal matrix  $O$  that does not have  $-1$  as an eigenvalue can be  
>expressed as  
> $O = (I + A)(I - A)^{-1}$   
>where  $A$  is skew-symmetric. I tried using Lagrange multipliers but it  
>got to be a big hairy mess. Any thoughts?

Yeah, my thought is that that hint is a mean trick, or I totally misunderstand something. Each column of an orthogonal matrix is a vector of norm 1, right? So each entry in each column (and therefore each entry in the matrix) is between  $-1$  and  $1$ . So the identity matrix has trace  $n$  (the size of the matrix), and every other orthogonal matrix has trace strictly less than  $n$ .

Lee Rudolph

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- *References:*
  - ◆ [\*Maximizing the trace\*](#)
    - ◇ *From:* garrettbaird2
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