

## 459.731 Theory of Poroelasticity

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### Assignment #1 (8 March)

due by 15 March 2010

1. Calculate the transformed stress components in 2D from  $\boldsymbol{\tau}' = \mathbf{R}\boldsymbol{\tau}\mathbf{R}^T$
2. Prove that determinant of stress is invariant
3. Using both transformation equations and eigenvalue method, find principal stresses and their orientation with a given stress  $\begin{pmatrix} 4 & 1 \\ 1 & 4 \end{pmatrix}$

4. The stress tensor values at a point P are given by the matrix

$$\boldsymbol{\tau} = \begin{pmatrix} 7 & 0 & -2 \\ 0 & 5 & 0 \\ -2 & 0 & 4 \end{pmatrix}$$

Determine the traction (stress) vector on the plane at P whose unit normal is

$$\mathbf{n} = (2/3, -2/3, 1/3)$$

5. Make an excel file which allows us to calculate the principal stresses and their orientations with a given stress matrix in 3D. In submitting this file, you must include a verification case that shows that the your excel file is reliable.