Problem-Set-Eigenvalues and Grammars

1. Solve the following from the book "Introduction to Formal Languages, Automata Theory and Computation" by Kamala Krithivasan and Rama R. Page Number: 52-53. Problems - 1,2,3,4,6,9,10,11,12.

2. For the following matrices, determine the characteristic roots and a basis of each of the associated invariant vector spaces:

   i. $\begin{bmatrix} -2 & -8 & -12 \\ 1 & 4 & 4 \\ 0 & 0 & 1 \end{bmatrix}$

   ii. $\begin{bmatrix} -3 & -9 & -12 \\ 1 & 3 & 4 \\ 0 & 0 & 1 \end{bmatrix}$

   iii. $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

   iv. $\begin{bmatrix} 2 & 2 & 0 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

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