9. Conditions of solvability

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- **EAP** solvable iff (A,B) reachable, i.e.
$$\rho(R) = \rho(B \,|\, AB \,|\, \dots \,|\, A^{n-1}B) = n$$

- **Stabilization Problem** solvable iff (A,B) stabilizable, i.e. all unstable poles are reachable.
$$\rho(\lambda_i I - A \,|\, B) = n \qquad \lambda_i \in Re \geq 0$$

- **Observer Problem:** solvable iff (A,C) observable, i.e.
$$\rho(O) = \rho\begin{pmatrix} C \\ CA \\ \vdots \\ CA^{n-1} \end{pmatrix} = n$$

- **Partial Observer problem:** solvable iff (A,C) detectable i.e. all unstable poles are observable
$$\rho\begin{pmatrix} \lambda_i I - A \\ C \end{pmatrix} = n \qquad \lambda_i \in Re \geq 0$$

Remarks:

- A system is stabilizable if the uncontrollable states are stable
- A system is detectable if the unobservable states are stable