Underdetermined VS overdetermined problem

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undetermined system : a system of linear equations or a system of polynomial equations is considered **underdetermined** if there are fewer equations than unknowns

단순하게, ***Underdetermined***는 미지수가 방정식보다 많은 경우이다.

overdetermined system : 반대로, 미지수가 방정식보다 적은 경우이다.

overdetermined: $(m>n)$ *more equations* ⋯(1)

(No solutions in most cases)

$$A\boldsymbol{x}=b \rightarrow \begin{bmatrix}1 & 1 & 2\\ 3 & 4 & 1\\ 3 & 7 & 1\\ 4 & 2 & 3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}=\begin{bmatrix}11\\ 2\\ -7\\ 21\end{bmatrix} \quad (m=4 > n=3)$$

determined: $(m=n)$ *same equ. and unknown* ⋯(2)

(Exact solution)

$$A\boldsymbol{x}=b \rightarrow \begin{bmatrix}1 & 1 & 2\\ 3 & 4 & 1\\ 3 & 7 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}=\begin{bmatrix}11\\ 2\\ -7\end{bmatrix} \quad (m=3 == n=3)$$

underdetermined: $(m<n)$ *more unknowns* ⋯(3)

(Infinitely many solutions)

$$A\boldsymbol{x}=b \rightarrow \begin{bmatrix}1 & 1 & 2\\ 3 & 4 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}=\begin{bmatrix}11\\ 2\end{bmatrix} \quad (m=2 < n=3)$$