


Rectangular Matrix A in $Ax = b$

- **What if** A is a rectangular matrix, e.g., $A \in \mathbb{R}^{m \times n}$, where $m \neq n$?

Person ID	Weight	Height	Is_smoking	Life-span
1	60kg	5.5ft	Yes (=1)	66
2	65kg	5.0ft	No (=0)	74
3	55kg	6.0ft	Yes (=1)	78


$$\begin{bmatrix} 60 & 5.5 & 1 \\ 65 & 5.0 & 0 \\ 55 & 6.0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 66 \\ 74 \\ 78 \end{bmatrix}$$

- Recall $m = \# \text{equations}$ and $n = \# \text{variables}$. $A \quad \mathbf{x} = \mathbf{b}$
- $m < n$: more variables than equations
 - Usually infinitely many solutions exist (under-determined system).
- $m > n$: more equations than variables
 - Usually no solution exists (over-determined system).
- To study how to compute the solution in these general cases, check out Lay Ch1.2 and Lay Ch1.5.