

Q107  
 Let  $Ax = b$  be a system of linear eq<sup>n</sup> where  $A$  is an  $m \times n$  matrix &  $b$  is a  $m \times 1$  col vector and  $x$  is an  $n \times 1$  col vector unknowns. WOF is false?

- A) The system has a sol<sup>n</sup> if and only if, both  $A$  and the augmented matrix  $[Ab]$  have the same rank. (T)
- B) If  $m < n$  &  $b$  is a zero vector, then the system has infinitely many sol<sup>n</sup> (T)
- C) If  $m = n$  &  $b$  is a non-zero vector, then the system has a unique sol<sup>n</sup>
- D) The system will have only a trivial sol<sup>n</sup> when  $m = n$ ,  $b$  is the zero vector ~~(rank)~~  
 $\text{rank}(A) = n$  (T)

$$Ax = b$$

$$r(A:b) = r(A) = n \rightarrow \text{unique}$$

$$r(A:b) = r(A) = r \rightarrow \infty \text{ many.}$$



A)


$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

$$f(a) = 2$$
$$f(a:b) = 3$$

ok soln  
exit karyn.

B)

$n < h$



A rectangular box is shown with a horizontal arrow pointing to the right and a curved arrow pointing clockwise, labeled  $B$ .

$\frac{1}{2} + \frac{1}{2} = 1$

eg:  $\begin{bmatrix} 1 & 3 & 4 & 0 \\ 2 & 4 & 6 & 0 \end{bmatrix} \xrightarrow{R_2 \leftarrow R_2 - 2R_1} \begin{bmatrix} 1 & 3 & 4 & 0 \\ 0 & -2 & -2 & 0 \end{bmatrix}$

$$AX = b = 0 \quad \begin{bmatrix} 1 & 3 & 4 \\ 0 & -2 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

Distance:  $x_1 + 3y + 4z = 0$  int base in mod 16  
 $-2y - 2z = 0$  mod 16

$$Z = -1$$

free variable

$3 - 2 = 1$   $\rightarrow$  1 variable  
scaling vertex  
factorial

$$\Rightarrow \sqrt{25-1}$$

$14 = 1$

$$x + 34 - 4 = 0$$

$$[1 + e^{\kappa}]$$

$$\# \text{ col} = 3$$

3-2 = 1 → # 10001

c)

$P(A) = \frac{2}{7}$

$$m=3$$

$$n=3$$

$$\infty$$

$$m \rightarrow \infty$$

UNIQUE SOL<sup>n</sup>  $f(A:b) = f(A) \quad n=3$

Ektion

—	—	—	—
—	—	—	—
—	—	—	—
—	—	—	—

$P(A) = 2$   
 $P(A \cdot B) = 3$   
No Sol

1	5	9
2	6	10
3	7	11
4	8	12

$$d) P(A) = n$$

-	-	(-)
-	(-)	-
(-)	-	-
e	e	e

$$\{v_1, v_2, v_3\}$$

$$\alpha_1 V_1 + \alpha_2 V_2 + \alpha_3 V_3 = 0$$

$\Rightarrow$  same scaling factor 0.




Q11  
2016  
Consider the system, each consisting of  $m$  linear eq<sup>n</sup> in  $n$  variable

7) If  $m < n$ , then all such systems have

ii) If  $m > n$ , then none of these systems

has a sol<sup>n</sup> then there exists a system exists

which has a sol<sup>n</sup> (D)

WOF is CORRECT

2, 11 & 111 are true

2) Only I, II, III are free

1) Only III is true

d) None of them

m linear eq.

$a_1$	$a_1$	$a_1$
$a_2$	$a_2$	$a_2$
$a_3$	$a_3$	$a_3$
$a_4$	$a_4$	$a_4$
$a_5$	$a_5$	$a_5$
$a_6$	$a_6$	$a_6$
$a_7$	$a_7$	$a_7$
$a_8$	$a_8$	$a_8$
$a_9$	$a_9$	$a_9$
$a_{10}$	$a_{10}$	$a_{10}$
$a_{11}$	$a_{11}$	$a_{11}$
$a_{12}$	$a_{12}$	$a_{12}$
$a_{13}$	$a_{13}$	$a_{13}$
$a_{14}$	$a_{14}$	$a_{14}$
$a_{15}$	$a_{15}$	$a_{15}$
$a_{16}$	$a_{16}$	$a_{16}$
$a_{17}$	$a_{17}$	$a_{17}$
$a_{18}$	$a_{18}$	$a_{18}$
$a_{19}$	$a_{19}$	$a_{19}$
$a_{20}$	$a_{20}$	$a_{20}$
$a_{21}$	$a_{21}$	$a_{21}$
$a_{22}$	$a_{22}$	$a_{22}$
$a_{23}$	$a_{23}$	$a_{23}$
$a_{24}$	$a_{24}$	$a_{24}$
$a_{25}$	$a_{25}$	$a_{25}$
$a_{26}$	$a_{26}$	$a_{26}$
$a_{27}$	$a_{27}$	$a_{27}$
$a_{28}$	$a_{28}$	$a_{28}$
$a_{29}$	$a_{29}$	$a_{29}$
$a_{30}$	$a_{30}$	$a_{30}$
$a_{31}$	$a_{31}$	$a_{31}$
$a_{32}$	$a_{32}$	$a_{32}$
$a_{33}$	$a_{33}$	$a_{33}$
$a_{34}$	$a_{34}$	$a_{34}$
$a_{35}$	$a_{35}$	$a_{35}$
$a_{36}$	$a_{36}$	$a_{36}$
$a_{37}$	$a_{37}$	$a_{37}$
$a_{38}$	$a_{38}$	$a_{38}$
$a_{39}$	$a_{39}$	$a_{39}$
$a_{40}$	$a_{40}$	$a_{40}$
$a_{41}$	$a_{41}$	$a_{41}$
$a_{42}$	$a_{42}$	$a_{42}$
$a_{43}$	$a_{43}$	$a_{43}$
$a_{44}$	$a_{44}$	$a_{44}$
$a_{45}$	$a_{45}$	$a_{45}$
$a_{46}$	$a_{46}$	$a_{46}$
$a_{47}$	$a_{47}$	$a_{47}$
$a_{48}$	$a_{48}$	$a_{48}$
$a_{49}$	$a_{49}$	$a_{49}$
$a_{50}$	$a_{50}$	$a_{50}$
$a_{51}$	$a_{51}$	$a_{51}$
$a_{52}$	$a_{52}$	$a_{52}$
$a_{53}$	$a_{53}$	$a_{53}$
$a_{54}$	$a_{54}$	$a_{54}$
$a_{55}$	$a_{55}$	$a_{55}$
$a_{56}$	$a_{56}$	$a_{56}$
$a_{57}$	$a_{57}$	$a_{57}$
$a_{58}$	$a_{58}$	$a_{58}$
$a_{59}$	$a_{59}$	$a_{59}$
$a_{60}$	$a_{60}$	$a_{60}$
$a_{61}$	$a_{61}$	$a_{61}$
$a_{62}$	$a_{62}$	$a_{62}$
$a_{63}$	$a_{63}$	$a_{63}$
$a_{64}$	$a_{64}$	$a_{64}$
$a_{65}$	$a_{65}$	$a_{65}$
$a_{66}$	$a_{66}$	$a_{66}$
$a_{67}$	$a_{67}$	$a_{67}$
$a_{68}$	$a_{68}$	$a_{68}$
$a_{69}$	$a_{69}$	$a_{69}$
$a_{70}$	$a_{70}$	$a_{70}$
$a_{71}$	$a_{71}$	$a_{71}$
$a_{72}$	$a_{72}$	$a_{72}$
$a_{73}$	$a_{73}$	$a_{73}$
$a_{74}$	$a_{74}$	$a_{74}$
$a_{75}$	$a_{75}$	$a_{75}$
$a_{76}$	$a_{76}$	$a_{76}$
$a_{77}$	$a_{77}$	$a_{77}$
$a_{78}$	$a_{78}$	$a_{78}$
$a_{79}$	$a_{79}$	$a_{79}$
$a_{80}$	$a_{80}$	$a_{80}$
$a_{81}$	$a_{81}$	$a_{81}$
$a_{82}$	$a_{82}$	$a_{82}$
$a_{83}$	$a_{83}$	$a_{83}$
$a_{84}$	$a_{84}$	$a_{84}$
$a_{85}$	$a_{85}$	$a_{85}$
$a_{86}$	$a_{86}$	$a_{86}$
$a_{87}$	$a_{87}$	$a_{87}$
$a_{88}$	$a_{88}$	$a_{88}$
$a_{89}$	$a_{89}$	$a_{89}$
$a_{90}$	$a_{90$	

n	var
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row  $\nwarrow$  m  $\nearrow$  n  
col

Diagram illustrating a 2D array structure with 3 rows and 4 columns. The first two rows are enclosed in brackets, and the third row is not. The first two rows have their last elements circled in green. Arrows point to the first and second columns.

Free me free.

105 011

ii)  $m > n$ ,

Diagram illustrating the steps of long division:

- Divide: 3 into 12.
- Multiply: 3 times 4.
- Subtract: 12 minus 12.

Difficultly many  
sold

no sol

ek car

$$\frac{m}{u} = n$$

A hand-drawn diagram of a 3x3 grid. The grid is formed by two horizontal lines and two vertical lines. The cells are as follows:

		○
	○	
○		

The circles are drawn in the top-right, middle-middle, and bottom-left cells.

Unique sol<sup>n</sup>

Infinitely many sol<sup>n</sup>

MgSO<sub>4</sub>

JIT  
JAM

suppose  $\alpha, \beta, \gamma \in \mathbb{R}$  Consider the  
given system of linear eq<sup>n</sup>

$$x + y + z = \alpha$$
$$\begin{aligned} x + y + z &= y \\ x + y + x &= y \end{aligned}$$

2) the system has atleast one sol<sup>n</sup> then  
we state points are True.

a) if  $\alpha = 1$  then  $\gamma = 1$

b)  $\beta = \frac{1}{\alpha}$  then  $V = \alpha$

c)  $\beta + 1$  then  $\alpha = 1$

d) if  $y=1$  then  $x=$

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} \alpha \\ \gamma \\ \beta \end{bmatrix}$$
$$Ax = b$$



$$\left[ \begin{array}{ccc|c} 1 & 1 & 1 & \alpha \\ 0 & \beta-1 & 0 & 0 \\ 0 & 0 & \alpha-1 & \beta \end{array} \right] \begin{array}{l} y \\ y \\ y \end{array}$$

Of the given eq<sup>n</sup> it has 3 sol<sup>n</sup>.

$$\left[ \begin{array}{ccc|c} 1 & 1 & 1 & \alpha \\ 0 & \beta-1 & 0 & 0 \\ 0 & 0 & \alpha-1 & \beta-\alpha \end{array} \right] \begin{array}{l} y \\ y \\ y \end{array}$$

$$\begin{array}{l} \beta-1=1 \\ \beta=2 \end{array} \quad \begin{array}{l} \alpha-1=1 \\ \alpha=2 \end{array}$$

~~if~~  $\alpha=1$

$$\left[ \begin{array}{ccc|c} 1 & 1 & 1 & 1 \\ 0 & \beta-1 & 0 & 0 \\ 0 & 0 & 0 & \beta-1 \end{array} \right] \begin{array}{l} y \\ y \\ y \end{array} \Rightarrow \text{infinite sol}^n$$

$\alpha=1$  then  $y=1$  for infinite many sol<sup>n</sup>

~~if~~  $\beta=1$

$$\left[ \begin{array}{ccc|c} 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & \alpha-1 & \beta-1 \end{array} \right] \begin{array}{l} y \\ y \\ y \end{array} \Rightarrow \text{infinite sol}^n$$

$y=\alpha$

c) if  $\beta \neq 1$  then  $\alpha=1$

$$\left[ \begin{array}{ccc|c} 1 & 1 & 1 & 1 \\ 0 & \beta-1 & 0 & 0 \\ 0 & 0 & 0 & \beta-1 \end{array} \right] \begin{array}{l} y \\ y \\ y \end{array}$$

infinite

$\beta \neq 1$  the  $y=1 \Rightarrow$  for infinite sol<sup>n</sup>.

d) if  $y=1$  then  $\alpha=1$

$$\left[ \begin{array}{ccc|c} 1 & 1 & 1 & \alpha \\ 0 & \beta-1 & 0 & 0 \\ 0 & 0 & \alpha-1 & \beta-1 \end{array} \right] \begin{array}{l} y \\ y \\ y \end{array}$$

$$\left[ \begin{array}{ccc|c} 1 & 1 & 1 & 1 \\ 0 & \beta-1 & 0 & 0 \\ 0 & 0 & 0 & \beta-1 \end{array} \right] \begin{array}{l} y \\ y \\ y \end{array}$$

if  $\beta \neq 1$  No sol<sup>n</sup>.

$$\left[ \begin{array}{ccc|c} 1 & 1 & 1 & \alpha \\ 0 & \beta-1 & 0 & 0 \\ 0 & 0 & \alpha-1 & \beta-\alpha \end{array} \right] \begin{array}{l} y \\ y \\ y \end{array}$$

$$y-\alpha = y-1 = 0$$

if  $\beta=1$   $y=1$   $\alpha=1$

$$\left[ \begin{array}{ccc|c} 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{array} \right] \begin{array}{l} y \\ y \\ y \end{array}$$

JEE ADV 2023

Let  $\alpha, \beta$ , and  $\gamma$  be real no's consider the following system of linear eq<sup>n</sup>.

$$x + 2y + z = 7$$

$$x + \alpha z = 11$$

$$2x + 3y + \beta z = \gamma$$

with I

p) if  $\beta = 1$  (7x-3) &

$y = 28$  then system

① No sol<sup>n</sup>



Q) If  $\beta = \frac{1}{2}(7\alpha - 3)$  &

$y \neq 28$  then the system has

R) If  $\beta \neq \frac{1}{2}(7\alpha - 3)$  where

$\alpha = 1$  &  $y \neq 28$

then the system has

② unique sol<sup>n</sup>

③ Infinite many sol<sup>n</sup>

Options

A)  $p \rightarrow 3$ ;  $Q \rightarrow 1$ ;  $R \rightarrow 2$

B)  $p \rightarrow 2$ ;  $Q \rightarrow 1$ ;  $R \rightarrow 3$

C)  $p \rightarrow 3$ ;  $Q \rightarrow 2$ ;  $R \rightarrow 1$

D)  $p \rightarrow 1$ ;  $Q \rightarrow 1$ ;  $R \rightarrow 2$

Q.  $\{\ln x, \ln x^2, \ln x^3\}$  is this set (i) or (ii)  
&  $\{\ln x, \ln x^2, \ln x^3\}$

$$\alpha \ln x + \beta 2 \ln x + \gamma 3 \ln x = 0$$

$$(\alpha + 2\beta + 3\gamma) \ln x = 0$$

$$\ln x \neq 0$$

so

$$\alpha + 2\beta + 3\gamma = 0$$

$$\alpha = 1, \beta = 1, \gamma = -1$$

means these must non-zero scalar  
hence LP

REVISION

11 if all  $\alpha_i = 0$  is the  
only soln.