* Show that if the following set of vector form basis :

$V_1 = (6, -3, 5)$

$V_2 = (2, 7, 5)$

$V_3 = (14, 6, 6)$

① $6K_1 + 2K_2 + 14K_3 = 0$

$-3K_1 + 7K_2 + 6K_3 = 0$

$5K_1 + 5K_2 + 6K_3 = 0$

$$A = \begin{bmatrix} 6 & 2 & 14 \\ -3 & 7 & 6 \\ 5 & 5 & 6 \end{bmatrix} \Rightarrow \det(A) = 6(12) - 2(-48) + 14(-50)$$

$$= -532$$

indep

span

So its linearly indep

and span $R^3$, so they are basis

* Must a basis for $P_n$ contain a polynomial of degree $k$ for each $k = 1, 2 \ldots n$? justify your answer & give an example. $K_0(1) + K_1(x) + K_2(x^2) + \cdots K_n x^n$

Closed under addition & scalar multiplication

* Show if the following statement is always correct.

"if $u$ is orthognal to $(w+v)$ then $u$ is orthognal to $v$ and $w$"

$\Rightarrow \quad u \cdot (w+v) = 0$

$(u \cdot w) + (u \cdot v) = 0$

* Assum that $V$ consists of all vectors that are defined in $R^3$ and have the following form : $\begin{bmatrix} x \\ y \end{bmatrix}$ is $V$ considered as a vector space or not when a) $y = x+1$

b) $y = x$

a) $y = x+1 \Rightarrow \begin{bmatrix} x \\ x+1 \end{bmatrix}$

let $u = \begin{bmatrix} u \\ u+1 \end{bmatrix}$, $V = \begin{bmatrix} V \\ V+1 \end{bmatrix}$

axiom 1 $\Rightarrow u + V = \begin{bmatrix} u+V \\ u+V+2 \end{bmatrix}$ not in $V$

(not closed under addition)

b) let $u = \begin{bmatrix} u \\ u \end{bmatrix}$, $V = \begin{bmatrix} V \\ V \end{bmatrix}$

axiom 1: $u + V = \begin{bmatrix} u+v \\ u+v \end{bmatrix}$ closed under addition

axiom 6: $\underset{\text{scalar}}{-} u = \begin{bmatrix} -u \\ -u \end{bmatrix}$ closed under scalar multiplication

it is a vector space when $\boxed{y = x}$

* Show that a matrix $A$ is nonsingular (invertible) if and only if $A^T$ is nonsingular.

$$\text{inv} \begin{cases} \to \text{square} \\ \to \det \neq 0 \end{cases}$$

if $A$ is singular then $A^T$ is singular

if $\det(A) \neq 0$, then $\det(A^T) \neq 0$ as $\det(A) = \det(A^T)$.

---

* Given that $A$ is a $3 \times 3$ upper triangular matrix, show that the corresponding cofactor matrix is a lower one.

let $A = \begin{bmatrix} a_1 & a_2 & a_3 \\ 0 & a_4 & a_5 \\ 0 & 0 & a_6 \end{bmatrix} \Rightarrow C_{11} = (-1)^2 \begin{vmatrix} a_4 & a_5 \\ 0 & a_6 \end{vmatrix}$

---

* Given that $A, B$ and $C$ are $3 \times 3$ matrices, show if the following statement is Always correct or not.

"$\det(A^T BC) = \det(C^T B^T A)$"

$\Rightarrow \det(A^T BC) = \det(A^T) * \cancel{\det(B)} * \cancel{\det(C)}$

$\det(C^T B^T A) = \cancel{\det(C^T)} * \cancel{\det(B^T)} * \det(A)$

$\det(A) = \det(A)$

$\det(C) = \det(C^T)$

$\det(A)\det(B)\det(C) = \det(C)\det(B)\det(A)$

---

* $ax_1 + bx_2 + x_3 = d$

$x_1 + x_2 + x_3 = c$

$+ e x_3 = 10$

① inconsistent . ② consistent with $\infty$ # of solutions

③ consistent with one solution

① inconsistent $\Rightarrow a = 1, b = 1, d = 2, c = 3, \boxed{e = 0}$

هاي الحالة $0 \neq 10$ فما رح يكون فيه solution

② consis. with one solution $\Rightarrow \det \neq 0$ (coef).

$\left[\begin{array}{ccc|c} a & b & 1 & d \\ 1 & 1 & 1 & c \\ 0 & 0 & e & 10 \end{array}\right] \Rightarrow \det = ae - be \neq 0 \begin{cases} e \neq 0 \\ a \neq b \end{cases}$

V.I

③ consis. with $\infty$ # of solutions $\Rightarrow \boxed{\begin{matrix} a = b = 1 \\ d = c \end{matrix}}$

改善 KAIZEN TEAM

* let $u = (3,-2,-4)$ , $v = (5,2,-8)$ , $w = (9,2,6)$ . Find:

1. distance betw $-3u$ and $-2v + 4w$
2. $u \cdot (v \times w)$
3. a unit vector that is orthognal to these vectors.
4. find the vector component of u along w and the vector comp. of u orthognal to w.

⇒ 1 $dist = norm(-3u - (-2v + 4w))$

$-3u = (-9, 6, 12)$

$-2v + 4w = (26, 4, 40)$

$-3u - (-2v+4w)) = (-35, 2, -28)$

$dist. = \sqrt{(35)^2 + (2)^2 + (28)^2} = 44.866$

2 $u \cdot (v \times w) \Rightarrow v \times w = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 5 & 2 & -8 \\ 9 & 2 & 6 \end{vmatrix} = 28\hat{i} - 102\hat{j} + -8\hat{k}$

$u \cdot (v \times w) = 3 * 28 + -2 * -102 + -4 * -8$

$= 320$

3 $u \times (v \times w) = \begin{vmatrix} 3 & -2 & -4 \\ 28 & -102 & -8 \end{vmatrix} = -392\hat{i} - 88\hat{j} - 250\hat{k}$

$norm = 473.189$

4 $proj_w u = \frac{u \cdot w}{\|w\|^2} \cdot w = \frac{3*9 - 2*2 - 4*6}{(\sqrt{9^2+2^2+6^2})^2} * (9,2,6)$

$= \frac{-1}{121}(9,2,6) \Rightarrow \left(\frac{-9}{121}, \frac{-2}{121}, \frac{-6}{121}\right)$

$u - proj_w u = (3,-2,-4) - \left(\frac{-9}{121}, \frac{-2}{121}, \frac{-6}{121}\right) = \left(\frac{372}{121}, \frac{-240}{121}, \frac{-478}{121}\right).$

* must a basis for $P_n$ contain a polynomial of degree $k$ for each $k = 1, 2, \ldots n$ ? justify your answer & give an 'example.

$\Rightarrow$ The standard basis for $P_n$ is $\{1, x, x^2, \ldots x^n\}$ so there must be a polynomial for every value of $k$ as if we want the basis for $P_2$ then it is $\{1, x, x^2\}$ so there is a polynomial of degree $k$ for each $(k = 1, 2)$ and if there wasn't a polynomial then it will not span $P_2$, so it is a must.

---

* Prove if $S$ is a basis for a vector space $V$, then for any vectors $u$ & $v$ in $V$ and any scalar $k$, the following relationships hold:

$(u+v)_S = u(S) + v(S)$

$(kv)_S = k(v)_S$

$\Rightarrow$ $S$ is a basis so it spans $V$ and linearly indep. $u$ & $v$ are subspaces for $S$ so both are in addition and scalar multiplication. (closed under addition and scalar multiplication).

---

* Show if the following set of vectors form basis:

$v_1 = (6, -3, 5)$, $v_2 = (2, 7, 5)$, $v_3 = (14, 6, 6)$.

$\Rightarrow$ check for indep. and span

$6k_1 + 2k_2 + 14k_3 = 0$

$-3k_1 + 7k_2 + 6k_3 = 0$

$5k_1 + 5k_2 + 6k_3 = 0$

$$A(\text{coef}) = \begin{bmatrix} 6 & 2 & 14 \\ -3 & 7 & 6 \\ 5 & 5 & 6 \end{bmatrix}$$

$\det(A) = 6(12) - 2(48) + 14(-50) = -532$

$\det(A) \neq 0$ so its linearly indep & span then these vectors form a basis

---

* If all entries of a square matrix $A$ are integers and $\det(A) = \pm 1$, show that all intries of $A^{-1}$ are integers.

$\Rightarrow$ $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, $\det(A) = \pm 1$

$A^{-1} = \frac{1}{\det(A)} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix} = \frac{1}{\pm 1} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ so all intries are integers.

* let $A$ be a square matrix whose det is integer. Show if the following statement is always correct or not "The det $(A^n)$ is integer".

$$\Rightarrow \det(A^n) = \underbrace{\det(A)}_{int} * \underbrace{\det(A)}_{int} \dots \quad \text{so its integer}$$

* Assume that $A$ & $B$ are the same invertible matrices. Show if the following statement is always correct " $A^{-1} + B^{-1}$ is invertible if $A+B$ is invertible".

$$\Rightarrow A^{-1}(A+B)$$
$$= (I + A^{-1}B)\,B^{-1}$$
$$= B^{-1} + A^{-1}$$ equvelant.

* Assume that $A$ & $B$ are 3X3 matrix that can be written as $A = kB^3$. Write the det of $A$ as a function of the det of $B$ and $k$.

$$\Rightarrow A = kB^3$$
$$A = kB*B*B$$
$$\det(A) = \det(kB)*\det(B)*\det(B)$$
$$= k^3 \det(B)*\det(B)*\det(B)$$
$$\det(A) = k^3(\det(B))^3$$

* $W * \begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 4 & 3 \\ 2 & 1 \end{bmatrix}$ find the value of matrix $W$ that satisfies the following equation:

$$\begin{bmatrix} 4 & 3 \\ 2 & 1 \end{bmatrix}\begin{bmatrix} 2 & -5 \\ -1 & 3 \end{bmatrix}$$

$$W = \begin{bmatrix} 5 & -11 \\ 3 & -7 \end{bmatrix}$$

* $u = (3, 4, -3)$, $v = (3, 2, -6)$, $w = (3, 0, 4)$ show that if $w$ can be written as LC of $u$ & $v$.

$$3k_1 + 3k_2 = 3 \Rightarrow \boxed{k_1 = 1 - k_2} \quad \text{subs in ②}$$
$$4k_1 + 2k_2 = 0 \Rightarrow 4(1-k_2) + 2k_2 = 0 \Rightarrow \boxed{k_2 = 2}, \boxed{k_1 = -1}$$
$$-3k_1 - 6k_2 = 4$$

$$-3(-1) - 6(2) = -9$$

$-9 \neq 4$ so can't be written as LC of $u$ & $v$

* Use cramer's rule to solve for $\cos\gamma$ and $\cos\beta$ in terms of a, b and c

$b*\cos\gamma + c*\cos\alpha = a$

$c*\cos\beta + a*\cos\gamma = b$

$a*\cos\alpha + b\cos\beta = c$

$$\Rightarrow A = \begin{array}{c} \begin{matrix} \cos\gamma & \cos\alpha & \cos\beta \end{matrix} \\ \begin{bmatrix} b & c & 0 \\ a & 0 & c \\ 0 & a & b \end{bmatrix} \end{array} \qquad RHS = \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

$$\det(A) = b(-ac) - c(ab)$$
$$= -2abc$$

$$A_1 = \begin{bmatrix} a & c & 0 \\ b & 0 & c \\ c & a & b \end{bmatrix} \Rightarrow \det(A_1) = a(-ac) - c(b^2 - c^2)$$

$$\cos\gamma = \frac{-a^2c - c(b^2 - c^2)}{-2abc} = \frac{a^2 + b^2 - c^2}{2ab}$$

$$A_3 = \begin{bmatrix} b & c & a \\ a & 0 & b \\ 0 & a & c \end{bmatrix} \Rightarrow \det(A_3) = b(-ab) - c(ac) + a(a^2)$$

$$\cos\beta = \frac{-ab^2 - c^2a + a^3}{-2abc} = \frac{ab^2 + c^2a - a^3}{2abc}$$

---

* let A be a 3x3 matrix where determinant value is integer, show if the following statement is always correct or not ?

" The $\det(A^n)$ is not prime when $n$ is larger than 2 ".

$\Rightarrow$ if $n > 2$, it is at least $(\det(A) * \det(A) * \det(A))$ it is not possible to be a prime number so the statement is always correct.

---

* Determine whether the given set of vectors forma an orthognal set:

$u = (2,5,8)$, $v = (6,1,9)$, $w = (-3,6,2)$.

$u \cdot v = 89$ not orthognal set.

طريقة الحل:

① بطلع $u.v$ ، $u.w$ ، $v.w$

وإذا كلهم يعطوني zero اذا وحدة

منهم لما أعطت صفر مابكونوا orthognal set

* Assume V consists of all vector in $R^3$ $\begin{bmatrix} q+t \\ 2r-t \\ 3S+t \end{bmatrix}$ is V considered as a vector space?

$\Rightarrow u = \begin{bmatrix} q_1+t_1 \\ 2r_1-t_1 \\ 3S_1+t_1 \end{bmatrix}$ $\quad V = \begin{bmatrix} q_2+t_2 \\ 2r_2-t_2 \\ 3S_2+t_2 \end{bmatrix}$

① addition $\Rightarrow u+v = \{(q_1+q_2)+2t, (2r_1+2r_2)-2t, (3S_1+3S_2)+2t\}$

the result is a vector of the same form as the vectors in V. So, it is closed under addition.

② scalar multiplication $\Rightarrow au = \{a(q_1+t_1), a(2r_1-t), a(3S_1+t)\}$

closed under scalar multiplication

So V can be considered as a vector space.

---

* let $W = \{(x+1), x \in R\}$ is W a vector space or not?

$\Rightarrow$ let $u = u+1$, $V = V+1$

check axiom 1 $\Rightarrow$ $u+V = u+1+V+1 = (u+V)+2$

the result is not a vector that is in the form of vectors in W

so its not closed under addition.

not a vector space.

---

* Plane 1: $3x+2y-z=10$ $\quad$ Find distance betw the two planes?

plane 2: $6x+4y-2z=30$

خطوات الحل:

① ايجاد نقطة على أحد الـ planes .

② تطبيق قانون المسافة بين نقطة و plane .

① Point on plane 1: $(0,0,-10)$ $P_0$

② distantce betw $P_0$ & plane 2

$$D = \frac{|6*0+4*0-2*-10-30|}{\sqrt{6^2+4^2+2^2}} = 6.681$$

改善 KAIZEN TEAM

* Assume that A is 3x3 matrix such that column of A sum to zero vector. Assume B is 3x3 matrix $B = \begin{bmatrix} 0 & 1 & 2 \\ 0 & 1 & 2 \\ 0 & 1 & 2 \end{bmatrix}$ what is the product of AB ?

$$A = \begin{bmatrix} a & b & c \\ -a & -b & -c \\ 0 & 0 & 0 \end{bmatrix} \Rightarrow AB = \begin{bmatrix} 0 & a+b+c & 2(a+b+c) \\ 0 & -a-b-c & 2(-a-b-c) \\ 0 & 0 & 0 \end{bmatrix}$$

---

* Determine whether the given set is linearly indendent.

$u = (2, \sin^2 x, \cos^2 x)$ $\quad V = (1, \sin x, \sin 2x)$.

$$2k_1 + k_2 = 0$$
$$\sin^2 x\, k_1 + \sin x\, k_2 = 0$$
$$\cos^2 x\, k_1 + \sin 2x\, k_2 = 0$$

$$\begin{bmatrix} 2 & 1 & 0 \\ \sin^2 x & \sin x & 0 \\ \cos^2 x & \sin 2x & 0 \end{bmatrix} \xrightarrow{R_1/2} \begin{bmatrix} 1 & 0.5 & 0 \\ \sin^2 x & \sin x & 0 \\ \cos^2 x & \sin 2x & 0 \end{bmatrix}$$

$-\sin^2 x\, R_1 + R_2$
$-\cos^2 x\, R_1 + R_3$

$$\begin{bmatrix} 1 & 0.5 & 0 \\ 0 & -\frac{1}{2}\sin^2 x + \sin x & 0 \\ 0 & \sin 2x - \frac{1}{2}\cos^2(x) & 0 \end{bmatrix} \xrightarrow{R_2/\sin x - \frac{1}{2}\sin^2 x}$$

$$\begin{bmatrix} 1 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0 & \sin 2x - \frac{1}{2}\cos^2 x & 0 \end{bmatrix} \xrightarrow{-(\sin 2x - \frac{1}{2}\cos^2 x)R_2 + R_3} \begin{bmatrix} 1 & 0.5 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \xrightarrow{-0.5R_2 + R_1}$$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \quad \begin{aligned} k_1 &= 0 \\ k_2 &= 0 \end{aligned}$$

trivial solution $\Rightarrow$ indep.

* $2x_1 + x_2 + \alpha x_3 = \lambda_1$

$x_1 + 3x_2 + \beta x_3 = \lambda_2$

$\alpha x_1 + \beta x_2 + 2x_3 = \lambda_3$

① single sol $\Rightarrow \begin{bmatrix} 2 & 1 & \alpha \\ 1 & 3 & \beta \\ \alpha & \beta & 2 \end{bmatrix}$ $\det(A) \neq 0$

$\alpha = 0,\ \beta = 0$

$\begin{bmatrix} 2 & 1 & 0 \\ 1 & 3 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ $\det(A) = -10$ so its inv.

$\lambda_1, \lambda_2, \lambda_3$ can take any values.

② No solution $\Rightarrow \det(A) = 0$

inconsistent

$\infty$ # of solution (consistent)

$\left[\begin{array}{ccc|c} 2 & 1 & \alpha & \lambda_1 \\ 1 & 3 & \beta & \lambda_2 \\ \alpha & \beta & 2 & \lambda_3 \end{array}\right]$ $\alpha = 2,\ \beta = 1 \Rightarrow \left[\begin{array}{ccc|c} 2 & 1 & 2 & \lambda_1 \\ 1 & 3 & \beta & \lambda_2 \\ \alpha & \beta & 2 & \lambda_3 \end{array}\right]$

$\lambda_1 \neq \lambda_3$

---

* Find a basis for the nullspace of: $A = \begin{bmatrix} 2 & 2 & -1 & 0 & 1 \\ -1 & -1 & 2 & -3 & 1 \\ 1 & 1 & -2 & 0 & -1 \\ 0 & 0 & 1 & 1 & 1 \end{bmatrix}$

طريقة الحل:

REF ①

# of parameters ② equal # of vectors

$R_1/2 \Rightarrow$, $R_1 + R_2$, $-R_1 + R_3$: $\begin{bmatrix} 1 & 1 & 0.5 & 0 & 0.5 & 0 \\ 0 & 0 & 1.5 & -3 & 1.5 & 0 \\ 0 & 0 & -1.5 & 0 & -1.5 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$ $\xrightarrow[\substack{1.5R_2 + R_3 \\ -R_2 + R_4}]{R_2/1.5}$ $\begin{bmatrix} 1 & 1 & -0.5 & 0 & 0.5 & 0 \\ 0 & 0 & 1 & -2 & 1 & 0 \\ 0 & 0 & 0 & -3 & 0 & 0 \\ 0 & 0 & 0 & 3 & 0 & 0 \end{bmatrix}$ $\xrightarrow[-3R_3 + R_4]{R_3/-3}$

$\begin{bmatrix} 1 & 1 & -0.5 & 0 & 0.5 & 0 \\ 0 & 0 & 1 & -2 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$

$x_1 = -t - r$

$x_2 = t$

$x_3 = -r$

$x_4 = 0$

$x_5 = r$

$V_1 = (-1, 0, -1, 0, 1)$ $V_2 = (-1, 1, 0, 0, 0)$

改善 KAIZEN TEAM

(3) $A = \begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 9 \\ 1 & 3 & 4 & 1 \end{bmatrix} \xrightarrow[-R_1+R_2]{-3R_1+R_2} \left[\begin{array}{cccc|c} 1 & 3 & 4 & 3 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -2 & 0 \end{array}\right] \xrightarrow{R_3/-2} \left[\begin{array}{cccc|c} 1 & 3 & 4 & 3 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{array}\right]$

Rank = 2 , nullity = 2

$x_1 + 3x_2 + 4x_3 + 3x_4 = 0$

$\boxed{x_4 = 0}$

$\boxed{x_3 = t}$, $\boxed{x_2 = r}$

---

*** $Ax = 0$ , can we consider the solution of H.S vector space?**

⇒ assume $w, u$ solutions for H.S

$Ax = 0$

$A(w+u) = 0 \Rightarrow Aw + Au = 0$ closed under addition

axiom 1

scalar

$A(kw) = 0 \Rightarrow A * 0 = 0$ closed under scalar multiplication

axiom 6

So we can consider the solution of H.S as vector space.

---

*** $Ax = b$, can we consider the solutions of system of linear equ. as a vector space?**

⇒ assume $w, u$ solutions for the system.

$Ax = b$

$A(w+u) \stackrel{?}{=} b$

$Aw + Au = 2b \Rightarrow 2b \neq b$ not closed under addition

So can't be considered as a vector space.

*** Find the rank and nullity of matrix A:**

1. $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ coeff.

Solution: $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \xrightarrow[-7R_1+R_3]{-4R_1+R_2} \left[\begin{array}{ccc|c} 1 & 2 & 3 & 0 \\ 0 & -3 & -6 & 0 \\ 0 & -6 & -12 & 0 \end{array}\right] \xrightarrow[6R_2+R_3]{R_2/-3} \begin{bmatrix} 1 & 2 & 3 & 0 \\ 0 & 1 & 2 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

Rank = # of leaders (indep var) = 2

nullity = # of columns(A) − Rank = 1

or ⇒ $x_1 + 2x_2 + 3x_3 = 0$  $\boxed{x_3 = t}$

$x_2 + 2x_3 = 0$

$\boxed{x_2 = -2t}$, $x_1 = -2t - 3t \Rightarrow \boxed{x_1 = -5t}$

→ # of parameters = 1

---

2. $A = \begin{bmatrix} 1 & 1 & 2 & 3 \\ 3 & 4 & -1 & 2 \\ -1 & -2 & 5 & 4 \end{bmatrix}$

solution:

$\begin{array}{l} -3R_1+R_2 \\ R_1+R_3 \end{array} \left[\begin{array}{cccc|c} 1 & 1 & 2 & 3 & 0 \\ 0 & 1 & -7 & -7 & 0 \\ 0 & -1 & 7 & 7 & 0 \end{array}\right] \xrightarrow{R_2+R_3} \begin{bmatrix} 1 & 1 & 2 & 3 & 0 \\ 0 & 1 & -7 & -7 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$

Rank = 2 , nullity ⇒ $x_1 + x_2 + 2x_3 + 3x_4 = 0$  $\boxed{x_1 = -9r - 10t}$

$x_2 - 7x_3 - 7x_4 = 0 \Rightarrow \boxed{x_4 = t}, \boxed{x_3 = r}$

$\boxed{x_2 = 7r + 7t}$

⇒ # of parameters = 2 = nullity

改善 KAIZEN TEAM