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Linear Algebra (MA3.101) **Lecture #7**
Instructor: Dr. Naresh Manwani **18.02.2019**

Outline. *We introduce Reinforcement Learning with the Multi Arm Bandit (MAB).*

1 Spanning Set

Lemma 1. *Let S_1 be a spanning set of* $\mathbf{W} \subset V.Suppose S_2$ *spans* S_1 *, then* S_2 *spans* $\mathbf{W}$*.*

Proof.

$$\mathbf{W} \subset \text{span}(S_1)$$

$$S_1 \subset \text{span}(S_2)$$

$$\text{span}(\text{span}(S_2))\text{=span}(S_2) \text{ (by definition of span)}$$

$\therefore S_2$ spans $\mathbf{W}$ □

Lemma 2. *Let* S=$\{\vec{a_1}, \ldots, \vec{a_n}\}$ *be a spanning set of W. Then* $S^{'} = S \backslash \{\vec{a_i}\} \cup \{c\vec{a_i} + \Sigma_{j=1 j \neq i}^{n} \vec{a_j}\}$, $c \neq 0, c \in \mathbf{F}$ *spans* $\mathbf{W}$.

Proof. To prove it,it's sufficient to show that $S^{'}$ spans S by using previous lemma.

$$\text{Clearly } \vec{a_j}\ _{j \neq i}, \in \text{S}^{'} \subset \text{span}S^{'}$$

$$\text{Let } \vec{a^{'}} = \{c\vec{a_i} + \Sigma_{j=1 j \neq i}^{n} \vec{a_j}\} \in S^{'}$$

$$\text{also } \vec{a_i} = c^{-1}(\vec{a^{'}} - \Sigma_{j=1 j \neq i}^{n} c_j \vec{a_j}) \ as\ c \neq 0, c_j \in \mathbf{F}$$

$$\text{as } \vec{a_i} \text{ can be written as linear combination of vectors} \in S^{'}$$

$$\therefore \vec{a_i} \in \text{span}(S^{'})\text{(by def. of span)}$$

$$\Rightarrow S^{'} \text{ spans S}$$

$\therefore$by using previous lemma $S^{'}$ spans $\mathbf{W}$ □