The mathematics of an arsenal of weapons

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Abstract

In this paper, I describe the mathematics of an arsenal of weapons.
The paper ends with "The End"

Introduction

The mathematics of an arsenal of weapons was known since antiquity.
In this paper, I describe the mathematics of an arsenal of weapons.

The mathematics of an arsenal of weapons

Let there be p **war materials** such that

$$M = \sum_{i=1}^{p} m_i$$

where
M is the total mass of the war materials
m_i is the mass of the i^{th} war material

Let there be n **weapon designs** such that, for $j \in \{1, 2, \ldots, n\}$,
the j^{th} weapon design is a **unique** p**-tuple** of **fractions** $0 \leq f_i^j \leq 1$
of the i^{th} war material.

such that we have

$$d_j \left(m_1, m_2, \cdots, m_p; f_1^j, f_2^j, \cdots, f_p^j \right) = \sum_{i=1}^{p} f_i^j m_i$$

and

$$\forall j \;\; 1 = \sum_{i=1}^{p} f_i^j$$

and

$$\forall i \;\; 1 = \sum_{j=1}^{n} f_i^j$$

Let q_j be the **quantity produced** of the j^{th} weapon design d_j.

Then the **total quantity of weapons**

$$Q = \sum_{j=1}^{n} q_j$$

And the **total mass of weapons**

$$W = \sum_{j=1}^{n} q_j d_j = \sum_{j=1}^{n} q_j \sum_{i=1}^{p} f_i^j m_i$$

By the **law of conservation of mass**, we must have

$$M = W$$

whence we obtain the **fundamental law of an arsenal of weapons**

$$\sum_{i=1}^{p} m_i = \sum_{j=1}^{n} q_j \sum_{i=1}^{p} f_i^j m_i$$

The End