Exercise 13.9.1

Introduction to Discrete Mathematics
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ABSTRACT. This is Exercise 13.9.1 from Apostol [Apo69, §13.9]:

Exercise 13.9.1. Let S be a finite sample space consisting of n elements. Suppose we assign equal probabilities to each of the points in S. Let A be a subset of S consisting of k elements. Prove that $P(A) = k/n$.

Solution. Let α be the probability assigned to each of the points in S; i.e., if $s \in S$, the $P(\{s\}) = \alpha$. We then have

$$1 = P(S) = P\left(\bigsqcup_{s \in S}\{s\}\right) = \sum_{s \in S} P(\{s\}) = \sum_{s \in S} \alpha = n\alpha.$$

Therefore, $\alpha = 1/n$.

Now let A be a subset of S with $|S| = k$. Then we have

$$P(A) = P\left(\bigsqcup_{s \in A}\{s\}\right) = \sum_{s \in A} P(\{s\}) = \sum_{s \in A} \frac{1}{n} = \frac{k}{n}.$$

$\square$

REFERENCES

[Apo69] Tom M. Apostol, *Calculus. Vol. II: Multi-variable calculus and linear algebra, with applications to differential equations and probability*, Second edition, Blaisdell Publishing Co. Ginn and Co., Waltham, Mass.-Toronto, Ont.-London, 1969. MR 0248290

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