Problem set 1. Due Monday, September 21.

Assume that the base field is the field of complex numbers \( \mathbb{C} \) throughout.

1. page 5, Problem 3.
2. page 5, Problem 6.
3. page 9, Problem 2. (For \( F = \mathbb{C} \) only.)
4. page 10, Problem 3.

5. Let \( A \) be an arbitrary algebra (not necessarily associative, commutative or Lie), and \( d: A \to A \) be a derivation. Denote by \( d^i \) the composition of \( d \) with itself \( (i \) times), here, as usual, \( d^0 = \text{id}_A \). Prove Leibnitz’ identity:

\[
\frac{1}{n!} d^n(xy) = \sum_{i+j=n} \frac{d^i(x)}{i!} \cdot \frac{d^j(y)}{j!}.
\]

Here \( n \geq 0, x, y \) are arbitrary elements of \( A \), \( \cdot \) denotes multiplication in \( A \), and the integers \( i \) and \( j \) on the right hand side are assumed to be non-negative.

6. Show that \( \mathfrak{sl}_n \) is a simple algebra for every \( n \geq 2 \). (The hint to Problem 6 on p. 10 may be helpful here.)