# MATH 314 ASSIGNMENT 4, FALL 2016

Due in class on Friday, February 12

Part 1. Read 3.1–3.5 of Hoffman–Kunze.

Part 2. Do and hand in the following problems in Hoffman–Kunze.

- 3.1, problems 9, 12
- 3.2, problems 7, 11
- 3.3, problem 5
- 3.4, problems 8, 10
- 3.5, problem 5

Part 3. (extra credit)

A. Find an $\mathbb{R}$-linear transformation $S$ from $\mathbb{C}$ to $\mathrm{M}_2(\mathbb{R})$, the $\mathbb{R}$-vector space of all $2 \times 2$-matrices with entries in $\mathbb{R}$ such that $S$ has the same property (b) as in problem 5 of §3.3, i.e.

$$S(z_1 \cdot z_2) = S(z_1)\,S(z_2) \quad \text{for all } z_1, z_2 \in \mathbb{C},$$

and

$$\dim_{\mathbb{R}}(\mathrm{Im}(T) \cap \mathrm{Im}(S)) = 1,$$

where $T : \mathbb{C} \to \mathrm{M}_2(\mathbb{R})$ is the linear transformation in problem 5 of §3.3. (Recall that $\mathrm{Im}(S)$ is the image of the linear transformation $S$.)

B. Does there exist a field $F$, a positive integer $n$, and two $n \times n$ matrices $A, B \in \mathrm{M}_n(F)$ such that $AB - BA = I_n$? (Compare this with problem 5 of §3.5.)