The range of the quiz on March 17th will be those in §1, §2, §4.1 and §4.2 in the lecture note, although some of the sample problems below are sort of outside the range. The actual quiz will very likely have more questions than shown below, but the scoring will be the same.

[CC: Cheng-Chiang will prepare blue pens and scratch papers.]

[CC: This is a closed book quiz.]

True/False questions: Write down **only T/F or O/X** (or whatever you are used to) for each problem. For each correct answer 2 points are awarded, and for each incorrect answer **1 point is taken**.

(1) Let $\mathbb{G}$ be a connected reductive group over $\mathbb{Q}_p$, and $G = \mathbb{G}(\mathbb{Q}_p)$. Suppose $Z(G)$ (the center in the abstract group sense) is trivial. Then $Z(\mathbb{G})$ (the center in the algebraic group sense) is trivial.

(2) Suppose $\mathbb{G}$ is a connected reductive group, $G = \mathbb{G}(\mathbb{Q}_p)$, $\mathfrak{g} = \operatorname{Lie} G$ and $X \in \mathfrak{g}$ be arbitrary. Then the **boundary** of $\operatorname{Ad}(G)X \subset \mathfrak{g}$ (i.e. the complement of $\operatorname{Ad}(G)X$ in its closure) is an analytic sub-manifold of $\mathfrak{g}$.

(3) Is it true that $\mathrm{GL}_n(\mathbb{Q}_p)$ is locally compact for every $n \in \mathbb{Z}_{>0}$?

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Short answers: Write down **just an integer** for each problem. For each correct answer 3 points are awarded.

(i) Let $p = 5$. Let $g = \begin{bmatrix} 1 & 0 \\ 5 & 5 \end{bmatrix} \in \mathrm{GL}_2(\mathbb{Q}_5)$. For any $n \in \mathbb{Z}_{>0}$ let

$$K_n = \{g \in \mathrm{GL}_2(\mathbb{Q}_5) \mid \text{ all entries in } g - \mathrm{id}_2 \text{ are in } 5^n\mathbb{Z}_5\}.$$

What is the index $[K_3 : gK_8g^{-1}]$ of the subgroup $gK_8g^{-1}$ in $K_3$?

(ii) Let $p$ be any fixed prime number. What is the number of $\{n = 1, 2, 3, ...\}$ such that $\mathrm{SL}_n(\mathbb{Q}_p)$ is compact?

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