

### Homework 3

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Deadline: 3rd July (23:55 JST), 2022

You can submit your solution at NUCT, by email (henrik.bachmann@math.nagoya-u.ac.jp) or hand it in physically.

**Exercise 10.** Show that  $\mathfrak{H}_*^1 = \mathfrak{H}_*^0[z_1]$ .

**Exercise 11.** Prove Proposition 2.26, i.e. show that for any  $w \in \widehat{\mathfrak{H}}^1$  we have  $\text{Li}_w^q = w1$ .

**Exercise 12.** Show that for  $f, g \in z\mathbb{Q}[[q, z]]$  we have

$$\begin{aligned}(af)(ag) &= a((af)g + f(ag) + \hbar fg), \\ (bf)g &= f(bg) = b(fg).\end{aligned}$$

**Exercise 13.**

- (i) Determine  $\zeta_q(e_{\bar{1}} \sqcup_q e_{\bar{2}} - e_{\bar{1}} *_q e_{\bar{2}})$  and consider the limit  $q \rightarrow 1$  if possible.
- (ii) Calculate  $\sigma(\sigma(e_{\bar{2}}) *_q \sigma(e_{\bar{2}}))$  and compare it with  $e_{\bar{2}} \sqcup_q e_{\bar{2}}$ .