Exercise 4

1. Find all the weak barbs of the processes below:

   (a) $(\nu\, b)(a(x).\overline{x}\langle b\rangle) \mid (\nu\, b)(\overline{a}\langle b\rangle \mid b(x))$

   (b) $!(\nu\, a)(\overline{a} \mid !(!b.\overline{c} \mid !a.\overline{b}))$

   (c) $(\nu\, b)(\overline{b}\langle a, b\rangle \mid !b(x, y).(\nu\, a)(\overline{y}\langle a, x\rangle)) \mid \overline{c}\langle a\rangle$

2. Find a separation context which proves:

   (a) $\overline{a} \not\cong \overline{b}$

   (b) $\overline{c}\langle a\rangle \not\cong \overline{c}\langle b\rangle$

   (c) $\overline{a} \mid \overline{a} \not\cong \overline{a}$

3. Show the inequality $P \not\cong Q$ where

$$P \stackrel{\text{df}}{=} (\nu\, a, b)(\overline{b}\langle a\rangle \mid b(x).(\overline{a}\langle y\rangle \mid \overline{y}\langle c\rangle)) \mid \overline{x}\langle y, z\rangle \mid y(y, z).z(x).\overline{x}$$

$$Q \stackrel{\text{df}}{=} \overline{y}\langle c\rangle \mid \overline{x}\langle y, z\rangle \mid y(y, z).y(x).\overline{x}$$

   (Hint: you have to find a closing substitution σ such that $P\sigma \not\cong Q\sigma$.)

4. Show that the following equivalences hold, using the laws seen during the lectures:

   (a) $(\nu\, b, c)(\overline{a}\langle b\rangle \mid c(x).P) \cong (\nu\, d)\overline{a}\langle d\rangle$

   (b) $a(x).\overline{a}\langle x\rangle \mid !(Q \mid Q) \cong !Q$