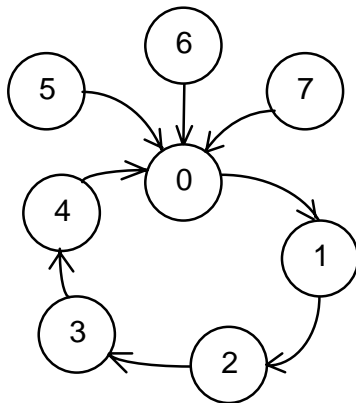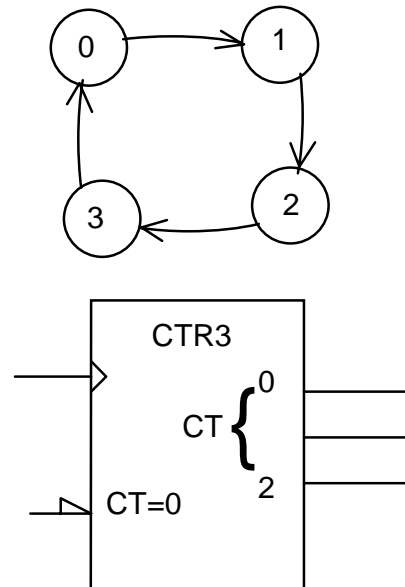# Digital Electronics

Answer Sheet 13

1. It can be seen that a down-counter is an up-counter but with the outputs taken from the $\overline{Q}$ outputs instead of the Q outputs.

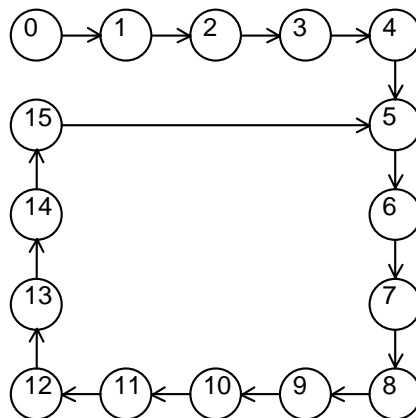2. Synchronous CLEAR: Asynchronous CLEAR:

3.

   a)

   b) The number of states in one complete cycle is 11. TC and OUT go high once per cycle and, hence, the output frequency in 16/11 kHz.

   c) For $N < 15$, $f_{out} = \dfrac{16}{16-N}$ kHz

   d) For $N = 15$, $f_{out} = 0$ and OUT always equals 1.