LCPB 20-21 exercise 5 (Restricted Boltzmann Machines - RBMs)

1. After the RBM has been trained, introduce a lower “temperature” in the sigmoid function (higher β) to generate the visible fantasy data from the hidden layer. Eventually introduce this choice also for the positive phase generating the hidden units.
2. Assess whether bit correction is working: generate a file the data before corruption and compare them with the corresponding fantasy data from RMB, generated either normally or with a high β as in point 1.
3. Introduce a fifth state “4” (see table below) and check which is the minimum number of hidden units M for the RBM to work properly. Eventually repeat this also when a sixth state “5” is introduced.

0	11001100
1	00111100
2	11000011
3	00110011
4	**11111111**
5	**10101000**

4. Repeat the above points for systems with larger error rate q=0.2.

5. Compare the convergence of the RBM parameters for the case SPINS=True (i.e. using “spins” {-1,1}) and the case SPINS=False (using bits {0,1}). This, for instance, can be visualized by showing the mean square increment <dw^2> of weights versus time (minibatch and/or epoch):

$$\langle dw^2 \rangle = \frac{1}{L\,M} \sum_{i<L,\, j<M} dw_{ij}^2$$