Christian Schindelhauer Freiburg, 2010-05-14

Exercise No. 4
Peer-To-Peer Networks
Summer 2010

Exercise 1 Consider the following random balls-and-bins experiments and decide, what kind of probability the outcome has. Differentiate between *constant probability*, *high/low probability*, and *extremely high/low probability*.

1. $2n$ balls into n:
   "*All bins have at least one ball.*"
2. n balls into n^2 bins:
   "*There exists a bin with exactly 2 balls.*"
3. n balls into $\frac{n}{\log n}$ bins:
   "*All bins have at least one ball.*"
4. n^2 balls into n bins:
   "*All bins have at least $\Omega(n)$ balls.*"

Exercise 2 Proof the following lemma about Chord from slide six of the lecture:

In an interval of length $w \cdot 2^m/n$ we find

- *$\Theta(w)$ peers, if $w = \Omega(\log n)$, w.h.p.*
- *at most $O(w \cdot \log n)$ peers, if $w = O(\log n)$, w.h.p.*