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## Advanced Algorithmic Techniques for Bioinformatics

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**Exercise sheet no. 6 (out: 16 Jan. 2008, in: 23 Jan. 2008)**

### 1. Information Theoretic Lower Bound for Group Testing.

Show that for  $M = 6$  and  $p^* = 2$  there is no (fully adaptive) group testing algorithm which uses exactly  $\log_2 \binom{M}{p} = 4$  tests.

The star on the  $p$  means you have to consider only the case when *exactly* 2 elements are positive.

### 2. Interval Group Testing.

Devise a 1-stage Interval Group Testing algorithm for the case  $p = 1$  (at most 1 positive), when the size of tests is bounded. This means that there is a constant  $d$  such that each test is of type  $\{i, i + 1, \dots, i + d - 1\}$ . Try to find the best possible algorithm for the cases  $d = 4$  and  $d = 2$ .

Give bounds on the performance of your algorithm.

What can you say about 2-stage algorithms with the same constraints?

### 3. Hwang Algorithm.

How many tests does Hwang algorithm use for  $p^* = 1$  and  $M = 32$ ? Is this the best possible bound achievable for this instance of the problem? Motivate your answer. (Also here,  $p^* = 2$  means that there are exactly 2 positive to find).