

## 2007 Paper 13 Question 12

### Complexity Theory

Let **Bounded Factor** denote the following decision problem:

Given positive integers  $n$  and  $k$ , decide whether  $n$  has a proper factor that is less than  $k$ .

For each of the following questions, give a detailed justification of your answer. Note that, in some cases, the answer may not be a simple “yes” or “no” but may instead be linked to open problems in complexity theory such as whether  $P=NP$  or the existence of one-way functions. In such cases, you should clearly explain the links and state what the consequences might be of both a positive and a negative answer to the question.

- (a) Is **Bounded Factor** in NP? [4 marks]
- (b) Is **Bounded Factor** in co-NP? [4 marks]
- (c) Is **Bounded Factor** NP-hard? [6 marks]
- (d) Is **Bounded Factor** in P? [6 marks]