INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
Parameterized Algorithms: Class Test 4 2020-21

Date of Examination: 12 November 2020
Duration: 40 Minutes + 10 Minutes (for scanning and uploading answer scripts on Moodle)
Full Marks: 20
Subject No: CS60083
Subject: Parameterized Algorithms
Department/Center/School: COMPUTER SCIENCE AND ENGINEERING

You may refer to the book and all lecture slides during the exam.

1. In the partial vertex cover problem, one needs to find if there exists a set of k vertices in an undirected graph that covers at least l edges. Show that the partial vertex cover problem, parameterized by k, belongs to the complexity class $W[1]$. You do not need to show $W[1]$-hardness.

   [10 Marks]

2. The *Exact Cover on Squares* problem takes a universe $\mathcal{U}$ of n points in $\mathbb{R}^2$ (2D plane), a family $\mathcal{F}$ of m axis parallel squares, and a positive integer k, and decides whether there exists a subfamily (set cover) $\mathcal{F}' \subseteq \mathcal{F}$ of size at most k such that each point is covered by exactly one given square. Can you derive a statement of the form "For no function f can there be a $f(k)\,n^{g(k)}$ algorithm for this problem unless ETH fails." What is your function g for such a statement?

   [10 Marks]

Best of luck