Algorithms and Data Structures
Jacobs University Bremen
Dr. Kinga Lipskoch

Course: CH-231-A
April 14th, 2020

Homework 10

- Submit one ZIP file per homework sheet which contains one PDF file (including pictures, computations, formulas, explanations, etc.) and your source code file(s) with one makefile and without adding executable, object or temporary files.
- The implementations of algorithms has to be done using C, C++, Python or Java.
- The TAs are grading solutions to the problems according to the following criteria: https://grader.eecs.jacobs-university.de/courses/ch_231_a/2020_1/Grading_Criteria_ADS.pdf

Problem 10.1 *Hash Tables* (11 points)

(a) (4 points) Given the sequence $< 3, 10, 2, 4 >$, apply the double-hashing strategy for open addressing to store the sequence in the given order in a hash table of size $m = 5$ with hash functions $h_1(k) = k \mod 5$ and $h_2(k) = 7k \mod 8$. Document all collisions and how they are resolved. Write down your computations.

(b) (7 points) Implement a hash table that supports insertion and querying with open addressing using linear probing. Select an h' function and explain why your selected h' is well-suited for your test data. The implementation should be consistent with the following or equivalent class specifications:

```
class Node {
  public:
    int key;
    int value;
    Node(int key, int value);
}
class HashTable {
  private:
    Node **arr;
    int maxSize;
    int currentSize;
  public:
    HashTable();
    hashCode(int key);
    void insertNode(int key, int value);
    int get(int key);
    bool isEmpty();
}
```

Problem 10.2 *Greedy Algorithms* (7 points)

(a) (2 points) Show that a greedy algorithm for the activity-selection problem that makes the greedy choice of selecting the activity with shortest duration may fail at producing a globally optimal solution.

(b) **Bonus** (5 points) Assuming an unsorted sequence of activities, derive a greedy algorithm for the activity-selection problem that selects the activity with the latest starting time. Your solution should not simply sort the activities and then select the activity.

How to submit your solutions

You can submit your solutions via *Grader* at **`https://grader.eecs.jacobs-university.de`** as a generated PDF file and/or source code files.
If there are problems with *Grader* (but only then), you can submit the file by sending mail to `k.lipskoch@jacobs-university.de` **with a subject line that starts with CH-231-A**.

Please note, that after the deadline it will not be possible to submit solutions. It is useless to send solutions by mail, because they will not be graded.

This homework is due by Monday, April 20th, 23:00.