ESW C/C++ – Exam Test September 6, 2018

Name:

Read the questions carefully, one question typically includes several parts! You can write answers directly on this sheet. Put your name on all sheets.

1. Software running in a virtualized system runs typically slower than the same software running under real system. Mention what are the reasons for lower performance and how can the software developer and/or system administrator reduce that performance degradation. *3 points*

2. When multi-threaded programs use dynamically allocated objects accessed from multiple threads (CPUs), it is necessary to ensure that objects are not deallocated before the last thread/CPU stops accessing it. This can be accomplished by using either *reference counting* (the object contains a counter of its “users” and is deallocated when it drops to zero) or *read-copy-update* (RCU).

   a) Compare these two methods from the point of read and update performance and mention other pros and cons.

   b) Explain when RCU frees the objects.

   Justify your answers. *5 points*

3. When profiling a program containing the code below using the command `perf record -e l1i_miss ./myprog`, the outcome was that the program is significantly slowed down by accesses to the `process_data` variable. Explain what is the cause of that slowdown and propose a change that removes it while maintaining the same functionality.

```
static inline void do_a(struct item *i) { ... }
static inline void do_b(struct item *i) { ... }
static inline void do_c(struct item *i) { ... }

void process_data(item_container &big_data)
{
    for (auto item: big_data) {
        do_a(item);
        do_b(item);
        do_c(item);
    }
}
```

3 points

4. Describe individual phases of C/C++ program compilation and their input and output (i.e. what happens inside the compiler). Explain few optimizations performed by the compiler. What is the *profile-guided optimization* and when it helps? *4 points*

Sum of points : 15