**LAB 4 PLAN AND RUBRIC**

**Date:** 29 April 2020

**Subject:** Computer Systems Design

**Topic:** Using high-level synthesis for hardware accelerator design

**Objectives:**

* Student can design the hardware accelerator using HLS methodology
* Students can perform high-level simulation of custom accelerators
* Students can perform C-RTL co-simulation of custom accelerators
* Students can implement custom accelerators using Xilinx Vivado Design Suite
* Students understand how use Xilinx Vivado HLS to accelerate algorithms on FPGAs
* Students can use HLS optimization directives to achieve PPA trade-off

**PLANNING**

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| timing | activities | resources | aim of activity |
| 10 min | **Introduction.** Outline the lab. | Study guide  (The section with Lab4 Task and Lab 4 Guide) | Prepare the students to the lab |
| 5 min | **Practice.** Understanding the task variant | Study guide  (The section with Lab4 Task and Lab 4 Guide) | Understand the lab variant and discuss it with the instructors. |
| 20 min | **Practice.** Designing HLS-based accelerator design for given algorithm | Study guide  (The section with Lab4 Task and Lab 4 Guide) | Developing the skill of designing hardware accelerators using HLS methodology |
| 10 min | **Practice.** Perform high-level simulation of designed accelerator in Vivado Design Suite environment | Study guide  (The section with Lab4 Task and Lab 4 Guide) | Developing the skill of high-level simulation of custom accelerators |
| According to the schedule | **Break** | | |
| 20 min | **Practice.** Optimize the designed accelerator for performance using HLS optimization directives | Study guide  (The section with Lab4 Task and Lab 4 Guide) | Developing the skill of using HLS optimization directives to achieve PPA trade-off |
| 5 min | **Practice.** Perform high-level synthesis of designed accelerator | Study guide  (The section with Lab4 Task and Lab 4 Guide) | Developing the skill of high-level synthesis of custom accelerators using Xilinx Vivado HLS |
| 20 min | **Practice.** Checking the results   1. Demonstration of the results to the instructors 2. Getting questions from the instructors | - | Checking the students results and grading.  Giving the questions and the practical task for understanding. It is needed to evaluate the students results. |
| According to the schedule | **Break** | | |
| 20 min | **Practice.** Integration of designed accelerator with embedded processor core using system bus interface | Study guide  (The section with Lab4 Task and Lab 4 Guide) | Developing the skill of integration of HLS-based accelerators using system bus interface |
| 15 min | **Practice.** Writing the software driver for custom hardware block | Study guide  (The section with Lab4 Task and Lab 4 Guide) | Developing the skill of writing the software drivers for custom HLS-based accelerators |
| 10 min | **Practice.** Uploading and debugging processor-enabled design with HLS-based accelerators on FPGA board | Study guide  (The section with Lab4 Task and Lab 4 Guide) | Developing the skill of uploading and debugging processor-enabled design with custom HLS-based accelerators |
| According to the schedule | **Break** | | |
| 10 min | **Practice.** Perform C-RTL co-simulation of the designed hardware accelerator (auxiliary task) | Study guide  (The section with Lab4 Task and Lab 4 Guide) | Performing C-RTL co-simulation of custom accelerators |
| 20 min | **Evaluation.** Checking the task for understanding | - | Checking the task for understanding and grading |
| 15 min | **Conclusion part.** Summarization of the lab | Study guide  (The section with Lab 4) | Summarize the main points of the lab. Structuring of the given knowledge and trained skills. |

**RUBRIC**

The rubric of the lab is focused on the overall performance, and it enables overall judgement of the student work. The result grade is depended on the result of practice part, the answers on the questions about the obtained results and the results of the task for understanding given after practical part. For the lab the students can get maximum 10 points.

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| Grade, points | Description |
| 0-5 | Students have partially completed the practical task |
| 6 | Students have successfully completed the practical task |
| 8 | Students have successfully completed the practical task and correctly answered the questions |
| 10 | Students have successfully completed the practical task, correctly answered the questions and done the auxiliary task |