Saarland University
Department 6.2 - Computer Science
Prof. Dr. W. J. Paul
Geng Chen

Multicore System Architecture - WS15/16

Exercise Sheet 4 (due: Nov 20, 2015)

Important:

- Each week on Friday one exercise sheet will be released. The solutions should be handed in before or after the next Friday lecture if not stated otherwise. For the admission to the exam you will need at least 50% of the points of the exercises.
- Tutorials: Group A: Wednesday 12:00 - 14:00 (Room 328, E 1 3, Tutor: Jonas Donia) and Group B: Tuesday 10:00 - 12:00 (Room 328, E 1 3, Tutor: Shahd Zahran)
- You are allowed to solve the exercise sheets in groups. Everybody who has his or her name on the solution must be able to present it in the tutorials. Everybody must present the solution of at least two exercises.
- Please, register for the lecture at the lecture's webpage until Nov 13th, 2015!
  http://www-wjp.cs.uni-saarland.de/lehre/vorlesung/rechnerarchitektur/ws15/anmeldung.php
  Also do not forget to register for the exam in the HISPOS system!
- The oral exam will take place in February. An exact date will be decided upon in class.

Tutor: _____

Name, Matr. Number: _____

Exercise 1: **(2)**

For the basic pipeline, assuming $SC-1$, alignment and no self modification. For $k \in [1:5]$ let $R \in reg(k)$ be a register or memory. Then prove

$$R^t_\pi = \begin{cases} R^{I^t_k}_\sigma & visible(R) \\ R^{I^t_k - 1}_\sigma & full^t_k \wedge \neg visible(R) \wedge used(R, I(c^{I^t_k - 1})) \end{cases}$$

Exercise 2: **(8)**

First, we consider the basic pipeline without self modification. Let $i = I(1,t)$ then prove

$$imout^t_\pi = imout^i_\sigma \qquad \text{(2 points)}$$

Next, we consider the self modification. Introduce the software condition $SC-1'$ and prove

$$imout^t_\pi = imout^i_\sigma \qquad \text{(2 points)}$$

You should state the place where $SC-1'$ is used. Then, design another forwarding circuit with logarithmic delay to discharge the $SC-1'$ (3 points). Do we need to modify $SC-2$ in this case and explain the reason. (1 point)

Exercise 3: **(1)**

In the stall engine, the $full$ bit is defined as follows in the lecture:

$$full^{t+1}_k = ue^t_k \vee stall^t_k$$

which is incorrect. Explain the reason and give the right definition.

Exercise 4: **(1)**

In the lecture hall, the initial definition of haz_A is

$$haz_A = hit_A[2] \wedge l.2 \vee hit_A[3] \wedge l.3$$

Explain the weakness of this definition.