science computer	Department of Computer Engieneering **Hardware/Software Codesign II** Prof. Dr. Wolfram Hardt, Dipl.-Inf. Michael Nagler	TECHNISCHE UNIVERSITÄT CHEMNITZ
SS 2015	LESSON 1 ESTIMATION	2015/06/04

Exercise 1

Some kind of algorithm and 4 according implementations D_i are given. For every D_i the value of a design parameter is estimated ($E(D_i)$) and measured ($M(D_i)$). The values can be found in the following table:

Impl. D	Estimation $E(D)$	Measurement $M(D)$	Accuracy $A(D)$
1	0	10	
2	25	25	
3	10	20	
4	11	10	

(a) Calculate the *Accuracy* $A(D_i)$ for the estimation of each implementation i.

(b) Calculate the *Fidelity* F of the estimation process.

Exercise 2

The delay times $del(v_i)$ (in μs) of different functional components v_i used in a system are given:

v_i	$del(v_i)$ in μs	$occ(v_i)$
MUX	50	3
ADD	25	2
SHIFT	10	5

(a) Calculate the *Maximum Operator Delay* T and the *Maximum Clock* f_{max}.

(b) What are advantages and disadvantages of this approach to determine the maximum clock?

(c) Calculate the *Clock Slack* $slack(T, v_i)$ for the different components v_i. Calculate it for 3 different clock times T: the maximum clock of (a), $25\mu s$ and $100\mu s$.

(d) Calculate the *Average Slack* $avgslack(T)$ and the *Clock Utilisation* $util(T)$. You can use the *Execution Occurrence* $occ(v_i)$ given in the table above. Calculate it for all 3 clock times T of (c).

Exercise 3

A program consists of 3 different types of commands that have different execution times. The processor runs with a clock of 20 MHz. The times (in clock counts) and the occurrence of the commands during the runtime of the program are given in the following table:

command type	execution time (in clocks)	occurrence
1	5	40
2	10	10
3	11	2

Calculate the *Execution Time* T of the program.

Exercise 4

The following *3-address program* is given:

```
1   s  := a
2   t1 := b
3
4   IF t1 = 1 GOTO [11]
5       s  := s  + a
6
7       t1 := t1 - 1
8
9       GOTO [4]
10
11  ...
```

The variables a and b are inputs with values from 1 to 10. Each command line has an execution time of 1.

Calculate the *Worst-Case Execution Time* $WCET$ for this fractional program.

Exercise 5

Calculate the *Communication Time* T_{com} that is necessary to transmit 2 MByte of data with a bit-serial, asynchronous communication standard. It uses a baudrate of 19200 baud, 1 startbit, 1 stopbit and 8 databits.