

# Quality Management of Software and Systems (WS 09/10)

## Problem Set 5

Thursday, January 28<sup>th</sup>, 2010

### Problem 1: Measuring and Scales

- What is the objective of measurement? Why is it relevant to software quality?
- What can be measured when doing a software development?
- Which measurement scales do you know? Please give a brief explanation and an example of each one.

### Problem 2: Halstead Metrics

To measure textual complexity of software, Halstead has proposed some metrics, based on the number of different and on the overall number of present operands and operators used. An operator is each symbol or key word indicating an action like +, -, \*, /, while, if, =, (, ), {, }, etc. Operands are all symbols indicating data, like variables, constants, jump, labels, etc.

The base factors for Halstead metrics are:

- $D1$  number of different operators
- $D2$  number of different operands
- $N1$  overall number of used operators
- $N2$  overall number of used operands
- $D = D1 + D2$  size of vocabulary
- $N = N1 + N2$  length of implementation

Based on these fundamental metrics, Halstead has defined other metrics to measure different aspects of a program. One such metric is  $D$ , the difficulty to write or understand a program

$$D = \frac{\eta_1 * N_2}{2\eta_{21}}$$

- Calculate the Halstead metrics for the given piece of code!

```
void ZaehleZchn(int &VokalAnzahl, int &Gesamtzahl)
{
    char Zchn;
    cin >> Zchn;
    while ((Zchn >= 'A') && (Zchn <= 'Z')
           && (Gesamtzahl < INT_MAX))
```

```

{
    Gesamtzahl = Gesamtzahl + 1;
    if((Zchn == 'A') || (Zchn == 'E')
        (Zchn == 'I') || (Zchn == 'O')
        (Zchn == 'U'))
    {
        VokalAnzahl = VokalAnzahl + 1;
    }// end if
    cin >> Zchn;
}// end while
}

```

b) Calculate the Halstead metrics and the cyclomatic number for the given piece of code!

```

char *FindeZchn(char * Schuhmenge, const char Element)
{
    char *Zeiger;
    for(Zeiger = Schuhmenge; *Zeiger; Zeiger++)
        if(*Zeiger == Element)
            return Zeiger;
    return NULL;
}

```

### Problem 3: Cyclomatic Number

Determine the cyclomatic number for the following flow graphs. Compare this with your intuitive impression.

