C2110 UNIX and programming

11th Lesson

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INVESTMENTS IN EDUCATION DEVELOPMENT

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➢ AWK

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- Script structure, script execution
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AWK

http://www.gnu.org/software/gawk/gawk.html

AWK is scripting language designed to **process text data**, either in text files or in streams. Language uses **string data types**, **asociative arrays** (arrays indexed by string keys) and **regular expressions**.

Adapted from www.wikipedia.org

AWK script structure

```
BEGIN {

}

{

}

/PATTERN/ {

}

END {

}
```

Block is executed before file processing (optional section)

Executed for each record

Arbitrary number of sections

Executed for each record matching PATTERN

Executed after the file is processed (optional section)

Each block is in curly brackets {}.
Some program blocks are optional – see description.
Default record separator is new line – one line = one record.

Script execution

```
1  BEGIN {
   }
2  {
   }
3  /VZOR/ {
   }
4  END {
   }
```

- Block BEGIN (1) is executed (if present) before file analysis.
  - **Record** from file is read. By default one record is whole line from input file or stream. Record is split to **fields**. By default words of line are fields.
  - Block (2) is executed for **any record**.
  - Block (3) is executed for any **record matching PATTERN**.
  - .... Possible other blocks are executed ....
- Block END (4) is executed (if present) after analyzing whole file content.

Text file analysis

```
54.7332   295.7275   128.4090  -508.1302  -155.6037     0.0000
51.3204   292.3619   176.5980  -494.7423  -164.7991     0.1822
40.6154   273.9238   164.5827  -488.9232  -163.0629     0.3793
52.5044   281.5944   153.4570  -484.6533  -168.5328     0.3528
62.5486   294.2701   155.3607  -483.6872  -169.1747     0.0033
```

```
Potential function:
     ntf     =       2, ntb     =       0, igb     =       5, nsnb    =      25
     ipol    =       0, gbsa    =       0, iesp    =       0
     dielc   =   1.00000, cut     = 999.00000, intdiel =   1.00000
```

Text file analysis

record

Field in record

```
54.7332   295.7275   128.4090   -508.1302   -155.6037    0.0000
51.3204   292.3619   176.5980   -494.7423   -164.7991    0.1822
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```

Showcase

input.txt

```
54.7332   295.7275   128.4090   -508.1302   -155.6037   0.0000
51.3204   292.3619   176.5980   -494.7423   -164.7991   0.1822
40.6154   273.9238   164.5827   -488.9232   -163.0629   0.3793
52.5044   281.5944   153.4570   -484.6533   -168.5328   0.3528
62.5486   294.2701   155.3607   -483.6872   -169.1747   0.0033
```

script.awk

```
{
    print $2;
}
```

simple block

```
$ awk -f script.awk input.txt
                or
$ awk '{ print $2; }' input.txt
```

```
295.7275
292.3619
273.9238
281.5944
294.2701
```

Block stucture

Comments are denoted by hash symbol #

```
# This block calculates sub-total and
# analyses values in 3rd and 4th column
{
    # comment
    i = i + 1;
    f = f + $2; # sub-total addition
    printf("Sub-total is %10.3f\n",f);
    if( $3 == 5 ) {
        k = k + $4;
    }
}
```

Commands should be on separate lines that may be ended by semicolon.
Semicolon is necessary if multiple commands are on same line.

Variables

Variable assignment:

```
A = 10;
B = "some text"
C = 10.4567;
D = A + C;
```

Variable value:

```
print A + C;
print B;
```

Must not contain spaces

Difference between BASH

```
A=5

echo $A
```

Variable value accessed by **$**

Special variables:

NF	Number of Fields in current record
NR	Number of Record
FS	Field Separator, **default is space and tabulator**
RS	Record Separator, **default is new line \n**
$0	Whole current record
$1, $2, $3 ...	Particular fields of current record

Variables, ...

$0	Whole record
$1, $2, $3 ...	Particular fields of current record

Symbol **$** enables access to particular record fields in script.

Example:

```
i=3;
print $i;
```

Prints third field value.

Running AWK scripts

Text file processing:

Un-direct running:

```
$ awk -f script.awk input.txt
```

Output is printed to screen

Analyzed text file

awk script

Language interpreter

Data may be sent through standard input:

```
$ awk -f script.awk < input.txt

$ cat file.txt | awk -f script.awk
```

Running AWK scripts, ...

Direct running

```
$ ./script.awk input.txt

$ ./script.awk < input.txt

$ cat file.txt | ./script.awk
```

script `script.awk` **needs** x (**executable**) permission and interpreter AWK (script first line).

```
#!/usr/bin/awk -f
{
    i += NF;
}
END {
    print "Word count is:", i;
}
```

Exercise

1. Create directory **awk-data** in your home folder.
2. Copy files **matice.txt**, **produkt.log** a **rst.out** from directory **/home/kulhanek/Data/AWK** to directory **awk-data**.
3. Write script, that prints **second column** of file **matice.txt**.
4. Write script, that prints **second and fourth column** from file **matice.txt**.

Math operations

If variable value is in numerical format, following arithmetic operators may be used:

++ Variable values is increased by one

```
A++;
```

-- Variable value is decreased by one

```
A--;
```

+ Sum of two values

```
A = 5 + 6;
A = A + 1;
```

+= Adds value to variable

```
A += 3;
A += B;
```

- Difference of two values

```
A = 5 - 6;
A = A - 1;
```

-= Subtracts value from variable

```
A -= 3;
A -= B;
```

***** Multiple of two values

```
A = 5 * 6;
A = A * 1;
```

***=** Multiplies variable by value

```
A *= 3;
A *= B;
```

/ Quotient of two values

```
A = 5 / 6;
A = A / 1;
```

/= Divides variable by value

```
A /= 3;
A /= B;
```

Command print

Command **print** is used for non-formatted print of strings and numbers.

Syntax:

```
print value1[,] value2[,] ...;
```

If values are separated by comma, in output space is inserted in between them

Examples:

```
i = 5;
k = 10.456;
j = "variable i value =";
print j, i;
print "variable k value =", k;
```

Exercise

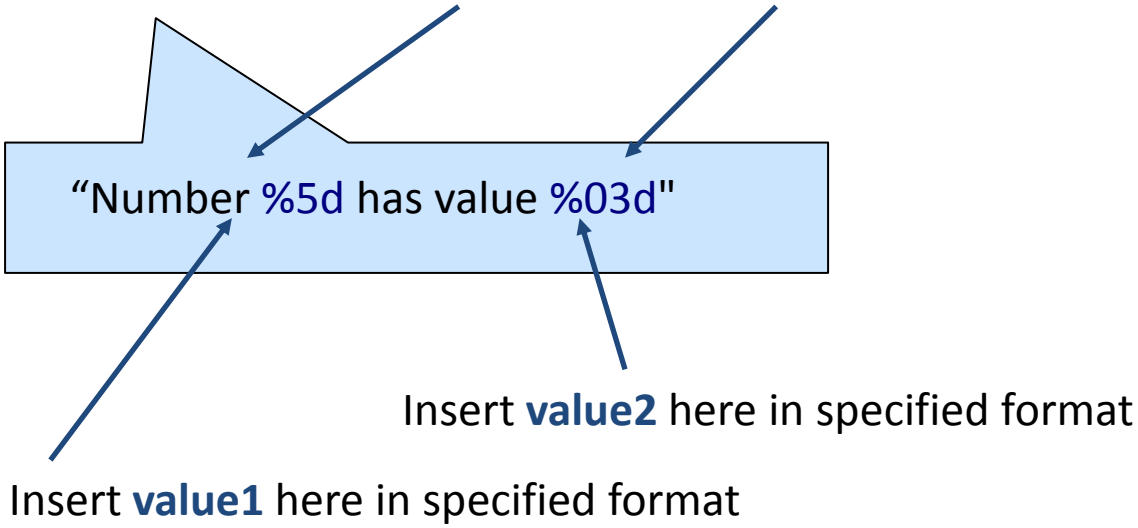
1. Write script, that **calculates sum of numbers in second column** of file **matice.txt**.
2. Write script, that prints **number of lines**, that are in file **matice.txt**. Use command **wc** to verify result.
3. Write script, that print **number of words**, that are in file **matice.txt**. Use command **wc** to verify result.
4. Write script, that calculates **average value** of numbers in second column in file **matice.txt**.

Function printf

Function **printf** prints **formatted** texts and numbers.

Syntax:

```
printf("format", value1, value2, ...);
```



Difference to BASH:

```
printf [format] [value1] [value2] ...
```

command

Arguments are separated by space

Conditions

```
if( logic_expession) {
      command2;
      ...
} else {
      command3;
      ...
}
```

If **logic_expression** is true, then **command2** is executed. In opposite case **command3** is executed.

Example:

```
if( $1 > max ){
      max = $1;
}
```

Difference to BASH

```
if command1; then
      command2
else
      command3
fi
```

Logic operators

Operators:

==	equal to
!=	not equal to
<	less then
<=	less or equal
>	greater then
>=	greater or equal
!	negation
&&	logical **and**
||	logical **or**

Examples:

```
j > 5
(j > 5)  && (j < 10)
(j <= 5)  || (j >= 10)
```

Cycles

```
for(initialization; condition; change)
{
        command1;
        ...
}
```

Example:

```
for(I=1;I <= 10;I++){
        sum = sum + $I;
}
```

Difference to BASH

```
for((initialization; condition; change)); do
        command1
done
```

Exercise

1. Write script, that prints **the greatest and lowest value** of **third column** in file **matice.txt**.
2. Write script, that prints from file **rst.out particular lines with 9 words**.
3. Write script, that prints **total sum** of all numbers in file **matice.txt**.