

# Workshop 1: Introduction to UNIX command-line

## Day 3

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"Swiss Army knife" set of tools

# Summary of Day 2

---

file permissions

---

cat

---

wc

---

>, >>, <

---

pipeline

---

ln -s

---

grep

---

regex

---

sed

---

# awk



- awk is both a
  - programming language
  - text processor

whitespace (spaces, tabs, etc.)  
to separate fields

- parsing and manipulating **tabular** data
  - iterates through the entire file line-by-line

```
awk '{action_to_take}' <file_to_parse>
```

# awk : Simple Uses

action\_to\_take



```
awk '{print}' <file_to_parse>
```

```
awk '{print $1}' <file_to_parse>
```



column number

```
awk '{print $1"\t"$3}' <file_to_parse>
```



delimiter

# Let's practice

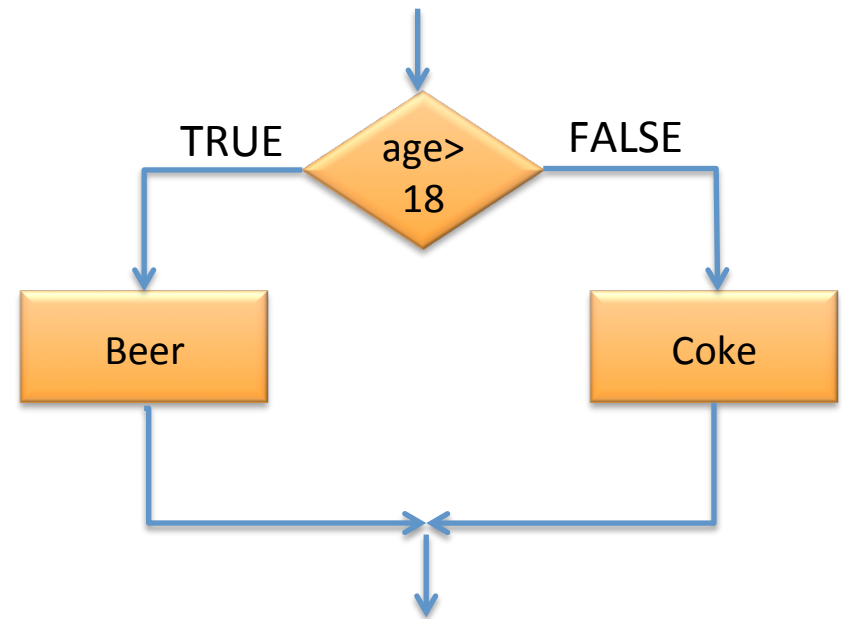


```
awk '{print}' hg19.gtf
awk '{print $1}' hg19.gtf
awk '{print $4}' hg19.gtf
awk '{print $1"\t"$4}' hg19.gtf
awk '{print $1"\t"$4*$5}' hg19.gtf
```

# awk : If statement

condition

```
if (age>18) then  
    print ("Beer Please")
```




# awk : If statement



*To Do:*

Print those employees who  
actually worked

Beth	4.00	0
Dan	3.75	0
Kathy	4.00	10
Mark	5.00	20
Mary	5.50	22
Susie	4.25	18



tabular data

```
awk '{if($3>0) print}' emp.data
```

# Data type

- Numbers
- **Text**

1	clothing	3141
1	computers	9161
1	textbooks	21312
2	clothing	3252
2	computers	12321
2	supplies	2242
2	textbooks	15462

*To Do:*

Print information about  
computers only

```
awk '{if($2=="computers") print}' sales.dat
```

use double quote

Text



# Let's practice!



```
awk ' {if ($3>0) print} ' emp.data
```

```
awk ' {if ($3>0) print $1"\t"$2*$3} ' emp.data
```

Beth	4.00	0
Dan	3.75	0
Kathy	4.00	10
Mark	5.00	20
Mary	5.50	22
Susie	4.25	18

# Let's practice!



```
awk '{if($4>50) print}' hg19.gtf
```

```
awk '{if($1=="chr2") print}' hg19.gtf
```

```
awk '{if($1=="chr2") print $1"\t"$3}' hg19.gtf
```

chr2	hg18_knownGene_GnfAtlas2	exon	237538	237602	0.000000	-	.	gene_id "204019_s_at"; transcript_id "uc002qvu.1";
chr2	hg18_knownGene_GnfAtlas2	exon	239731	239852	0.000000	-	.	gene_id "204019_s_at"; transcript_id "uc002qvu.1";

# awk : sum

- Calculate sum of a particular column

```
awk ' {sum+=$2} END { print sum} ' emp.data
```

New variable

“+=” means  
to add the  
value to the  
variable sum

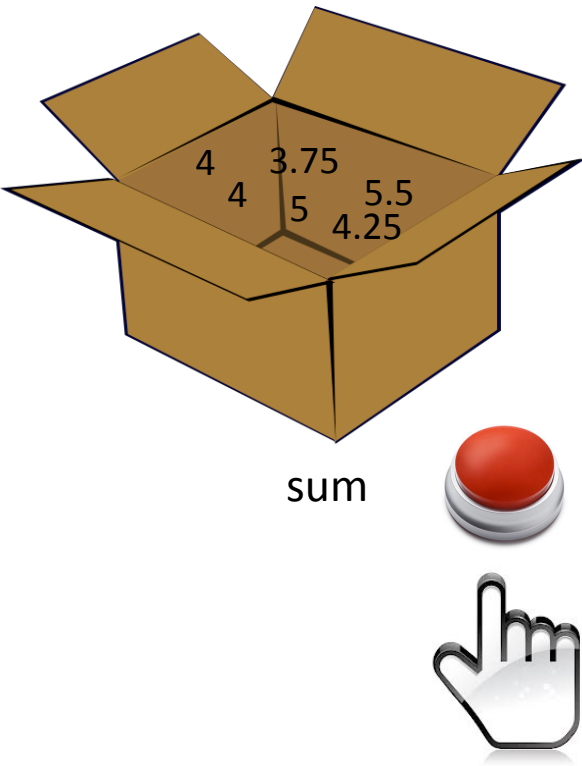
Do it until  
the end of  
the file



A variable is like a **box** where we can store a value and reuse this same value multiple times in our program.

# Variable is like a box

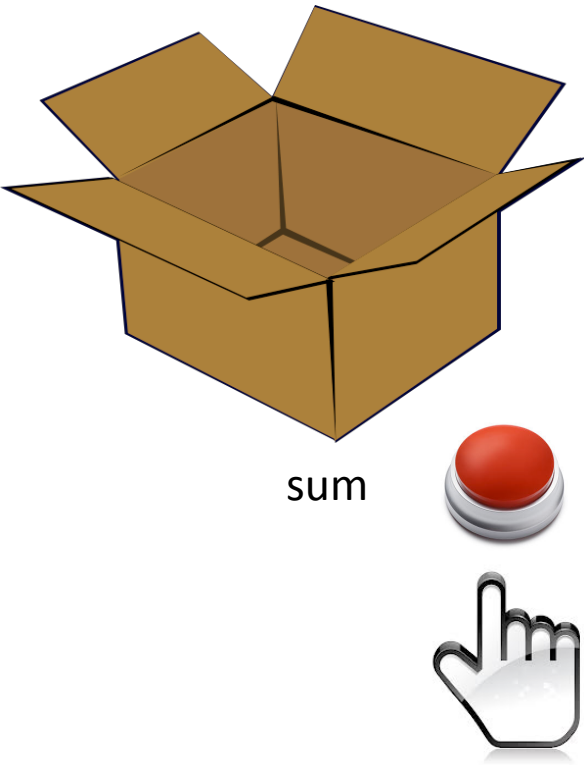
```
awk ' {sum+= $2} END { print sum} ' emp.data
```



Beth	4.00	0
Dan	3.75	0
Kathy	4.00	10
Mark	5.00	20
Mary	5.50	22
Susie	4.25	18

# Variable is like a box

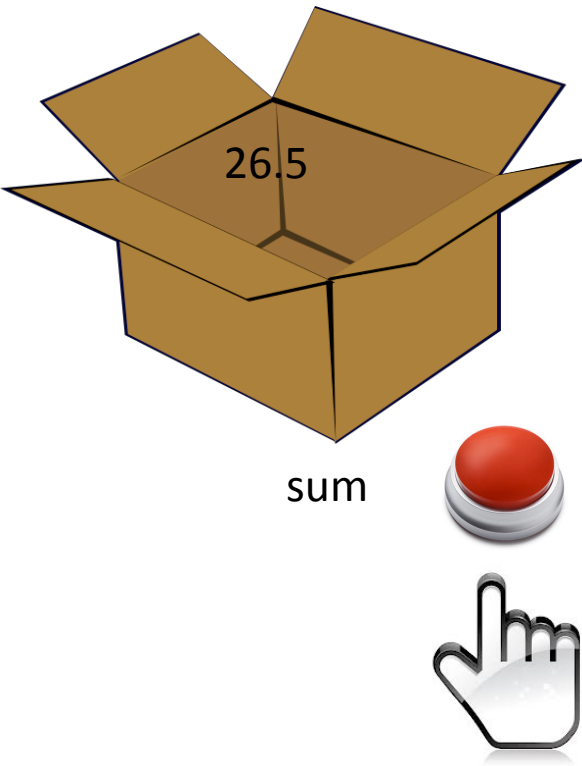
```
awk ' {sum+=$2} END { print sum} ' emp.data
```



Beth	4.00	0
Dan	3.75	0
Kathy	4.00	10
Mark	5.00	20
Mary	5.50	22
Susie	4.25	18

# Variable is like a box

```
awk ' {sum+=$2} END { print sum } ' emp.data
```



Beth	4.00	0
Dan	3.75	0
Kathy	4.00	10
Mark	5.00	20
Mary	5.50	22
Susie	4.25	18

# Let's practice!



```
awk '{sum+=$4} END {print sum}' hg19.gtf
```

```
awk 'END {print NR}' hg19.gtf
```

```
wc -l hg19.gtf
```

```
awk '{sum+=$4} END {print sum/6000}' hg19.gtf
```

```
awk '{sum+=$4} END {print sum/NR}' hg19.gtf
```

```
awk '{if($1=="chr2") sum+=$4} END {print sum}' hg19.gtf
```

chr2	hg18_knownGene_GnfAtlas2	exon	237538	237602	0.000000	- .	gene_id "204019_s_at"; transcript_id "uc002qvu.1";
chr2	hg18_knownGene_GnfAtlas2	exon	239731	239852	0.000000	- .	gene_id "204019_s_at"; transcript_id "uc002qvu.1";

# Sort

- will rearrange the lines in a text file so that they are sorted, numerically and alphabetically.

```
sort [OPTION]... [FILE]...
```

Options :

- **-n** - numerical ordering
- **-k** - sort by a particular column



# Sort a file



```
sort regex.txt
```

**regex.txt**

beat

brat

boat

bat

banana

Sort a text file



```
sort -n regex.txt
```

Sort a file with numbers

# Sort by column



```
sort -k 2 sales.dat
```



Column number



```
sort -k 3n sales.dat
```

**sales.dat**

1	clothing	3141
1	computers	9161
1	textbooks	21312
2	clothing	3252
3	...	

# Uniq

- Removes duplicate lines from a file\*

```
uniq [OPTION]... [INPUT]
```

Options :

- **-c** - how many times each line occurred
- **-d** - print only duplicated lines

\*assumes that the file is sorted

# Let's practice



```
$ sort -n numbers.txt >numbers_sort.txt
$ uniq numbers_sort.txt
$ sort numbers.txt | uniq
$ uniq -d numbers_sort.txt
$ uniq -c numbers_sort.txt
```

2 7

a line of the file

How many times it occurs

**numbers.txt**

3  
4  
5  
7  
2  
1  
6  
7

# Shell scripts

- If you have a bunch of commands you'd like to automate, you can put them on separate lines of a file.



# My first shell script!

Following steps are required to write shell script:

- Use any **vi** editor like to write shell script.
- After writing shell script set execute permission for your script

# My first shell script!

```
vi script.sh
```



```
#!/bin/bash  
echo "My first script"
```



```
chmod u+x script.sh
```

```
./script.sh
```

# More scripting



- Let's create a bash script which will split <gtf> into files corresponding to every chr (2,3,21), save every file in separate directory called chr  $\${i}$ \_gtf.



# More scripting

```
#!/bin/bash
```

← vi script.sh



```
echo "My first script"
```

```
mkdir chr2_gtf
```

```
mkdir chr3_gtf
```

```
mkdir chr21_gtf
```

```
./script.sh hg19.gtf
```

```
grep "chr2\s" $1 >chr2_gtf/chr2.gtf
```

```
grep "chr3\s" $1 >chr3_gtf/chr3.gtf
```

```
grep "chr21\s" $1 >chr21_gtf/chr21.gtf
```

# Environmental modules

- set you environment to be able to run bioinformatics tools

```
module load <modulefile>
```



```
bowtie  
BWA  
samtools  
tophat
```



# Let's practice



- `[serghei@login1 test]$ tophat`
- `-bash: tophat: command not found`
- `[serghei@login1 test]$ module load tophat`
- `[serghei@login1 test]$ tophat`

# How to use qsub

- **qsub** is the command used for job submission to the cluster. It takes several command line arguments and can also use special directives found in the submission scripts or command file.

**L**

```
qsub -cwd -V -N <name of the proccess> -l  
h_data=<MEM_NEEDED>,time=24:00:00 run.sh
```

amount of memory  
(in megabytes M, or  
gigabytes G) that your  
job will require  
4GB-32GB

command to be run

# Let's practice!



```
echo "My first qsub"  
sleep 36000
```

run.sh

- `qsub -cwd -V -N test -l h_data=1G,time=1:00:00 run.sh`
- `qstat | grep serghei`



Displays all the jobs which  
are running on hoffman2

# History



- `history | grep awk`
- `history >history_w1.txt`



All UNIX commands from  
the workshop in one file



convert columns to rows awk



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**linux - How to transfer the data of columns to rows (with aw...**

[stackoverflow.com/.../how-to-transfer-the-data-of-colum...](#) ▾ Stack Overflow ▾

Mar 2, 2012 - How to transfer the data of **columns to rows** (with **awk**)? .... How can you **convert** a matrix back into a list of lists? Change of coordinates for ...

**how to convert rows into column using awk? - Stack Overflow**

[stackoverflow.com/.../how-to-convert-rows-into-column-...](#) ▾ Stack Overflow ▾

Jul 26, 2012 - 822 526006 1343315205 1.4.2 32 0.000000 13.048815 ... 0 0 0 ... Try this: **awk** '{printf("%s ", \$0)}'. using a pipe: whatever\_your\_command | **awk** ...

**awk - How to convert columns to rows in unix? - Stack Ove...**

[stackoverflow.com/.../how-to-convert-columns-to-rows-i...](#) ▾ Stack Overflow ▾

Oct 1, 2013 - zoo1 ---- cat dog mouse zoo2 ---- lion tiger zebra ... for the example in your question, this one-liner works: **awk -v RS= '/----/{next}{gsub(/\n/, ";")}'** file.

**[SOLVED] Converting columns to lines using AWK - LinuxQ...**

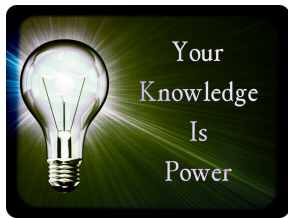
[www.linuxquestions.org](#) ▸ Forums ▸ Non-\*NIX Forums ▸ Programming ▾

Nov 3, 2011 - 11 posts - 4 authors

Hi everybody, I need to **convert columns** into **rows** in my file using **awk**. The file looks like: 6 5 7 8 6 5 7 8 6 5 7 8 The output should be like this: ...

<http://www.linuxquestions.org/questions/programming-9/converting-columns-to-lines-using-awk-911677/>

# Do Biologists have to become Programmers?



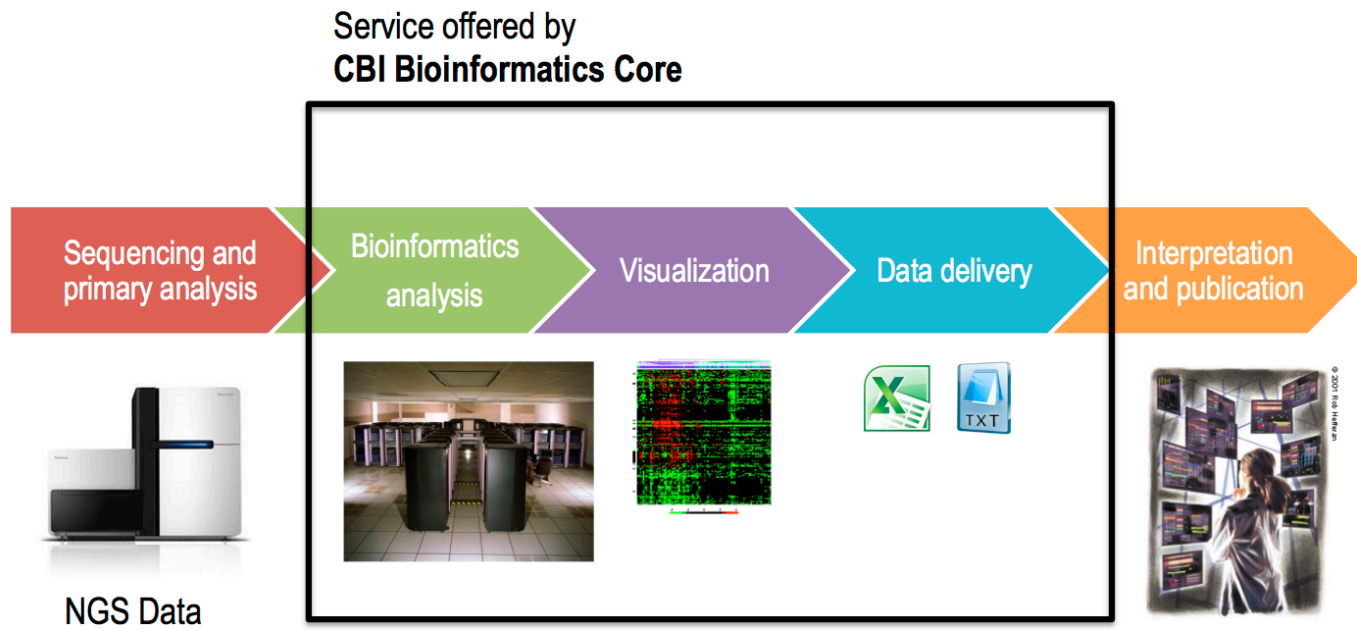
\*provided in the  
class

\*free and easy to use



# QCB Bioinformatics Core

- offers next-generation sequencing data processing and analysis service (pilot stage)
  - RNA-Seq



# Thanks!

- Please take a few minutes to fill the survey