Sheet 3

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3-1

(c)

```
> junit20 = myread.csvdata("src/data/junit20.tsv")
> mode(junit20$tstamp2)
[1] "numeric"
> class(junit20$tstamp2)
[1] "POSIXct" "POSIXt"
> junit20$tstamp2
 [1] "2004-11-17 23:07:28 UTC" "2002-09-01 00:29:52 UTC"
 [3] "2002-08-31 18:44:09 UTC" "2002-08-23 20:43:51 UTC"
 [5] "2001-05-21 21:50:15 UTC" "2001-04-08 02:18:42 UTC"
 [7] "2001-04-01 23:22:15 UTC" "2001-01-17 01:02:18 UTC"
 [9] "2001-01-10 00:39:50 UTC" "2000-12-03 15:36:14 UTC"
[11] "2000-12-03 15:36:14 UTC" "2004-11-17 23:47:23 UTC"
[13] "2004-11-13 01:33:00 UTC" "2002-08-31 18:44:09 UTC"
[15] "2002-08-23 20:43:51 UTC" "2002-02-14 21:58:36 UTC"
[17] "2002-02-07 00:43:07 UTC" "2002-02-06 22:12:01 UTC"
[19] "2002-02-06 21:42:19 UTC" "2001-05-21 21:50:15 UTC"
> junit20$tstamp2[1]
[1] "2004-11-17 23:07:28 UTC"
> junit20$tstamp2[2]
[1] "2002-09-01 00:29:52 UTC"
> junit20$tstamp2[1] - junit20$tstamp2[2]
Time difference of 808.9428 days
> junit20$tstamp2[2] - junit20$tstamp2[1]
Time difference of -808.9428 days
> class(junit20$tstamp3)
[1] "numeric"
> mode(junit20$tstamp3)
[1] "numeric"
> junit20$tstamp3
 [1] 1100732848 1030840192 1030819449 1030135431  990481815  986696322
 [7]  986167335  979693338  979087190  975857774  975857774 1100735243
[13] 1100309580 1030819449 1030135431 1013723916 1013042587 1013033521
[19] 1013031739  990481815
> junit20$tstamp2 - junit20$tstamp3
 [1] "1970-01-01 UTC" "1970-01-01 UTC" "1970-01-01 UTC" "1970-01-01 UTC"
 [5] "1970-01-01 UTC" "1970-01-01 UTC" "1970-01-01 UTC" "1970-01-01 UTC"
 [9] "1970-01-01 UTC" "1970-01-01 UTC" "1970-01-01 UTC" "1970-01-01 UTC"
[13] "1970-01-01 UTC" "1970-01-01 UTC" "1970-01-01 UTC" "1970-01-01 UTC"
[17] "1970-01-01 UTC" "1970-01-01 UTC" "1970-01-01 UTC" "1970-01-01 UTC"
```

tstamp2 is a POSIXct object using the following structure for each element: `"y-m-d h:m:s UTC"`
tstamp3 is a numeric value in seconds, which is added on the base date of 1.1.1970. The tstamp3 elements represent the same date index-wise as the tstamp2 elements do, e.g.
junit20$tstamp3[1] = 1100732848 = "2004-11-17 23:07:28 UTC" = junit20$tstamp2[1].
The result of junit20$tstamp2[1] - junit20$tstamp2[2] is a time difference of 808.9428 days.
We could also subtract the larger date from the smaller date, which would result in a time difference of -808.9428 days.
For the subtraction junit20$tstamp2 - junit20$tstamp3 we are not
surprised that the result is always the base date of 1.1.1970 because
we subtract the same values from each other, which are given in 2 different formats.

(d) Evaluation

```
> junit = myread.csvdata("src/data/junit.tsv")
> zile = myread.csvdata("src/data/zile.tsv")
> jikes = myread.csvdata("src/data/jikes.tsv")

> raw.hours(junit)

::: Raw Hours
hour     :    0    1    2    3    4    5    6    7    8    9   10   11   12   13
14   15   16   17   18   19   20   21   22   23
commits  :   82   21   32    3    8    5   10   10    8   10    1    0    0    2
1  187    2   14   20    3   30   45    9  120
> raw.hours(jikes)

::: Raw Hours
hour     :    0    1    2    3    4    5    6    7    8    9   10   11   12   13
14   15   16   17   18   19   20   21   22   23
commits  :  261  486  215  190  233  294  276  324  257  144  256   64   55  340
368  415  241  245  372  245  354  415  398  174
> raw.hours(zile)

::: Raw Hours
hour     :    0    1    2    3    4    5    6    7    8    9   10   11   12   13
14   15   16   17   18   19   20   21   22   23
commits  :  353  268  227  102   19   49    0    0   21    2   13   50   38   82
115  101   44  192  114  107   43  117  127  350
> raw.weekdays(junit)

::: Raw Weekdays
day      :  mon  tue  wed  thu  fri  sat  sun
commits  :   61   30   83   65   47  103  234
> raw.weekdays(jikes)

::: Raw Weekdays
day      :  mon  tue  wed  thu  fri  sat  sun
commits  :  761 1142 1432  931 1202  704  450
> raw.weekdays(zile)

::: Raw Weekdays
```

```
day      :  mon  tue  wed  thu  fri  sat  sun
commits  :  458  276  410  312  413  313  352
```

Where are the minimum and maximum values (i.e., hours/weekdays of particularly high or low activity)?

```
Junit: high activity: around hours 15, 23 and 0; weekdays sun, sat
       low activity: around hours 3, 10-14, 16 and 19; weekdays tue, fri
Jikes: high activity: around hours 1, 15 and 21; weekdays wed, fri, tue
       low activity: around hours 12 and 11; weekdays sun
Zile: high activity: around hours 0 and 23; weekdays mon
       low activity: around hours 6, 7 and 9; weekdays tue
```

How much smaller or bigger are peak values compared to the average?

```
Junit: average commits per hour: ~26 -> peak values: 0, 187; average commits per day: 89 -> peak values: 30, 234
Jikes: average commits per hour: ~276 -> peak values: 55, 486; average commits per day: 946 -> peak values: 450, 1432
Zile: average commits per hour: ~106 -> peak values: 0, 353; average commits per day: 362 -> peak values: 276, 458
```

Are there more commits during work days or weekend?

```
Junit: work days: 286; weekend: 337 => there are a bit more commits during weekend.
Jikes: work days: 5468; weekend: 1154 => there are a lot more commits during workdays.
Zile: work days: 1869; weekend: 665 => there are a lot more commits during workdays.
```

At which hour is the sum of commits from all projects the highest?

```
-> At 1 am there have been 21 + 486 + 268 = 775 commits.
```

Conclusions

```
=> Junit could be a project by developers who work in their freetime because they work during evening/night too, and especially at weekends.
=> Jikes could be a global large open source project because there are high commit rates at each hour (considering different time zones) almost every day.
=> Zile could be a global open source project because there are high commit rates at many hours (considering different time zones) every day.
```

3-2

(a, b, c) Plots per project

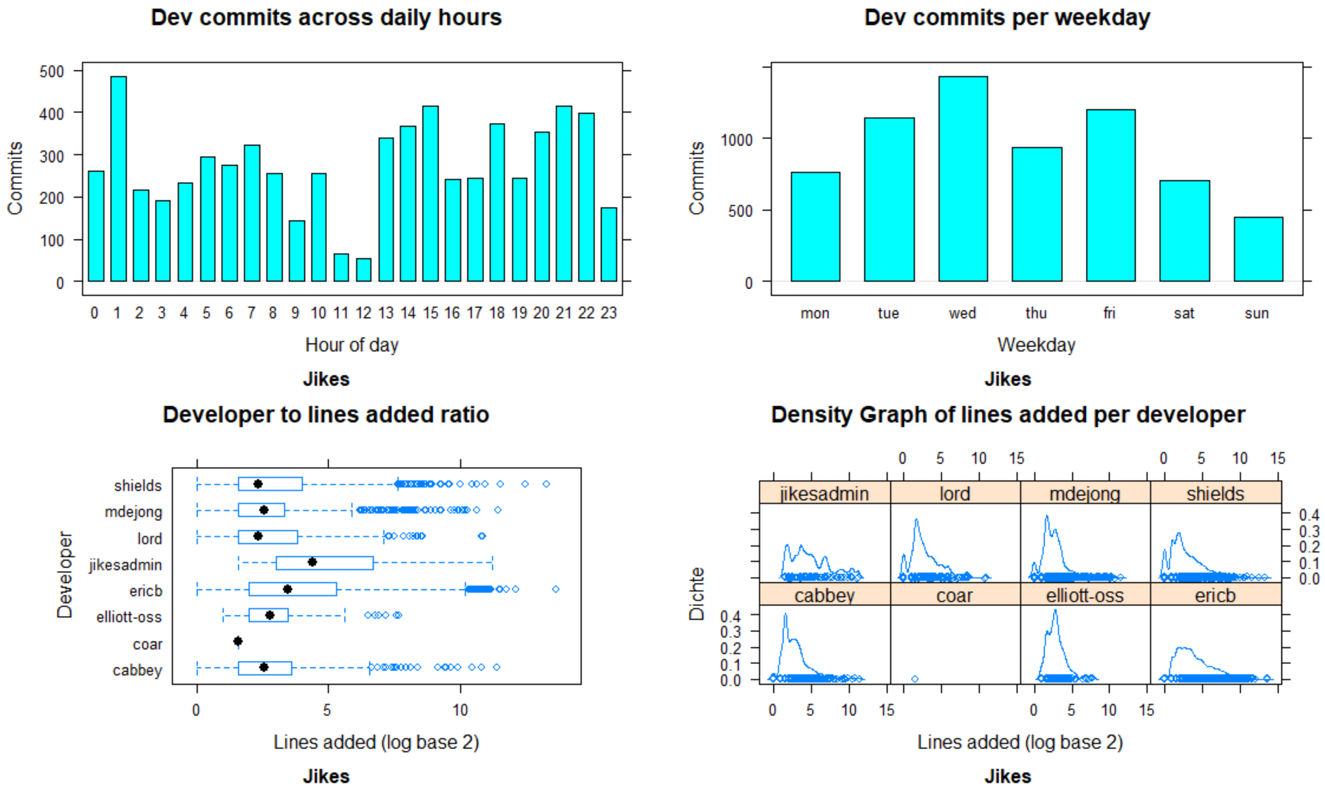
(a)

plot.default draws a scatter plot that can contain labels for axes and a title. plot.table is a version of plot.default for table input parameters that creates a bar plot for one dimensional tables, and a mosaic plot for tables with a dimension higher than 1. plot.factor is a version of plot.default for factor input parameters and it creates a bar plot for one dimensional factors, a box plot if numeric values are used in the second dimension of the input, and a spine plot if factors are used in the second dimension of the input.

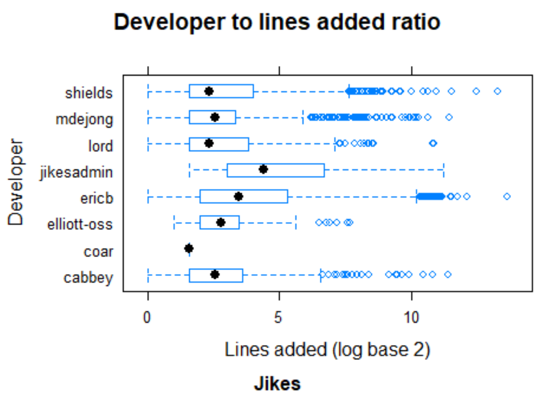
Seeing the hourly and weekly activities from 3.1 d) graphically doesn't make a difference to us. We can't find new conclusions about the projects.

How to get all 4 plots in one window per project (4 windows in total):
NOTE: All plots were created with lattice instead of R default plots to be able to put them all in a grid.

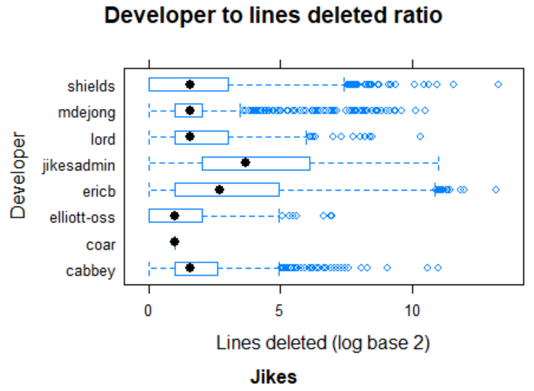
```
> myplot.test()
```



We can see that on the Jikes project, commits occur throughout the day, every day. There's lower commit counts during lunchtime (11:00-13:00) and slightly less on sundays.

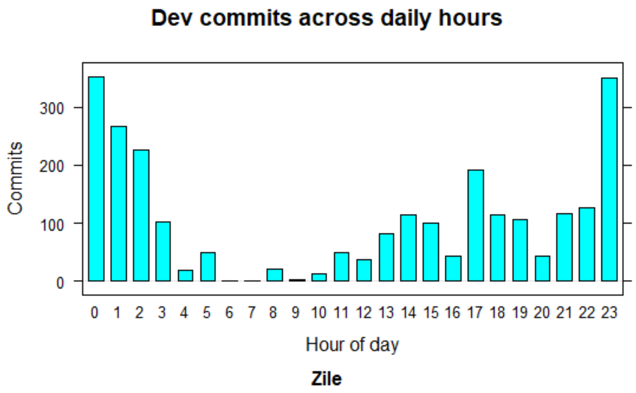

Developer to lines added ratio

Jikes

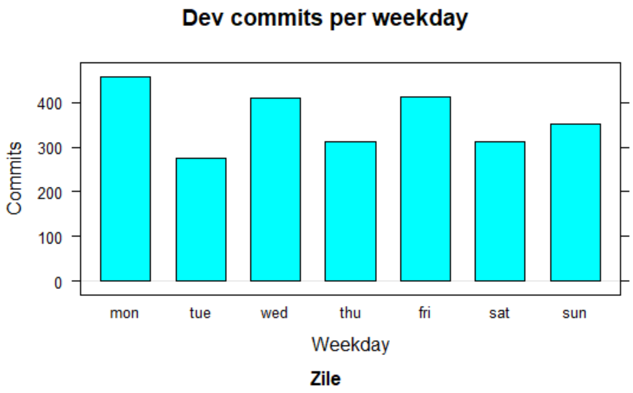

Developer to lines deleted ratio

Jikes

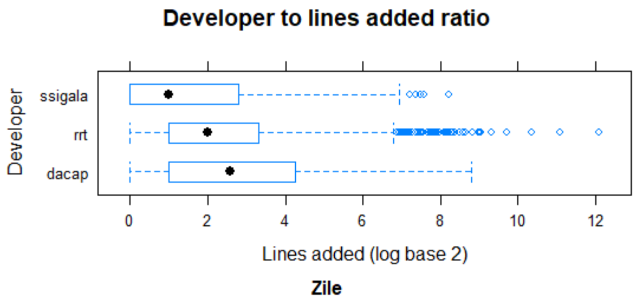
On average, devs who add more lines also delete more lines. (as seen on both boxplot figures).


Dev commits across daily hours

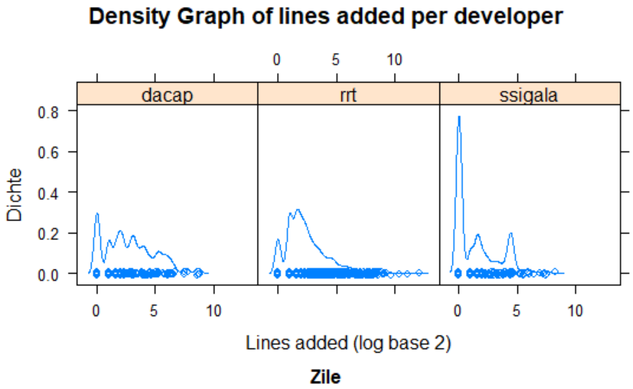
Zile


Dev commits per weekday

Zile


Developer to lines added ratio

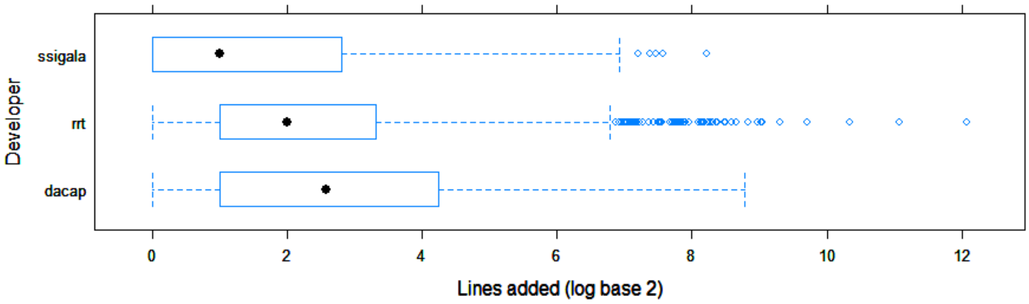
Zile


Density Graph of lines added per developer

Zile

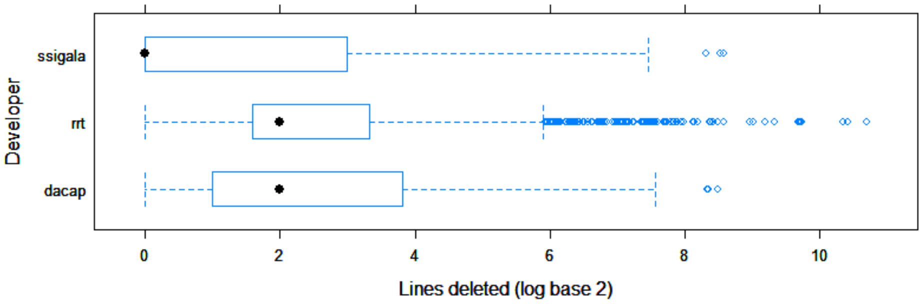
Developers seem to start to commit starting from 10:00 daily and stop around 3:00 to 5:00. Most activity is late at night between 23:00 and 2:00. The weekly commit behavior stays mostly the same.

Developer to lines added ratio



Zile

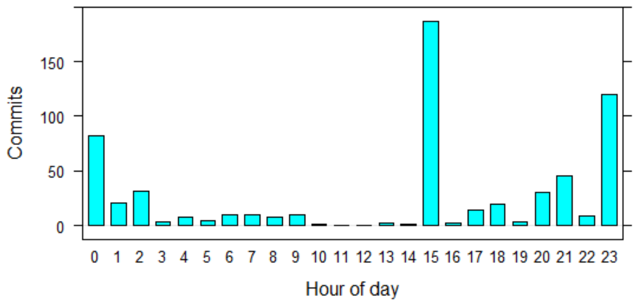
Developer to lines deleted ratio



Zile

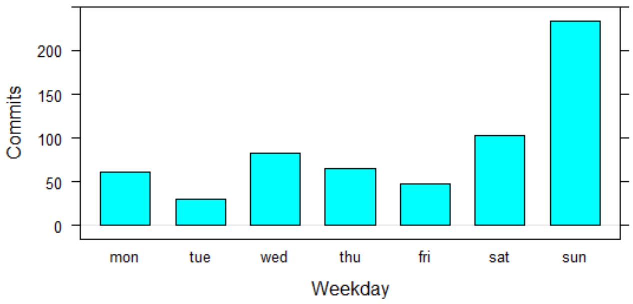
While rrt and dacap seem to have very similar lines added to lines deleted behavior, ssigala seems to add much more lines than they delete.

Dev commits across daily hours



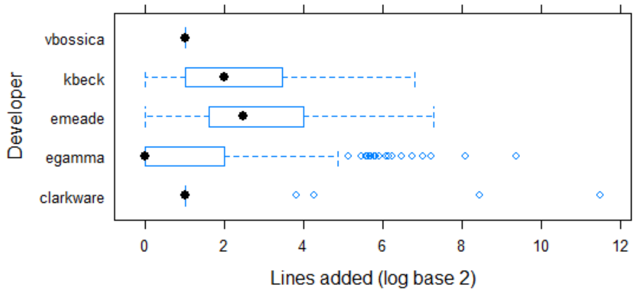
JUnit

Dev commits per weekday



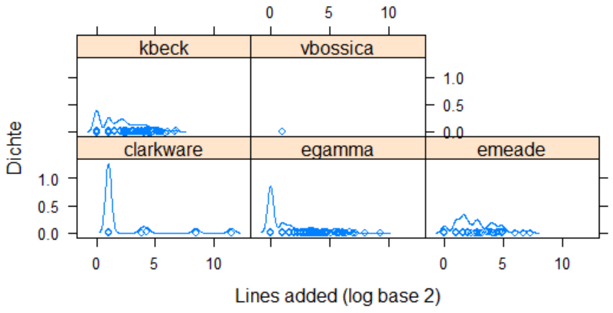
JUnit

Developer to lines added ratio



JUnit

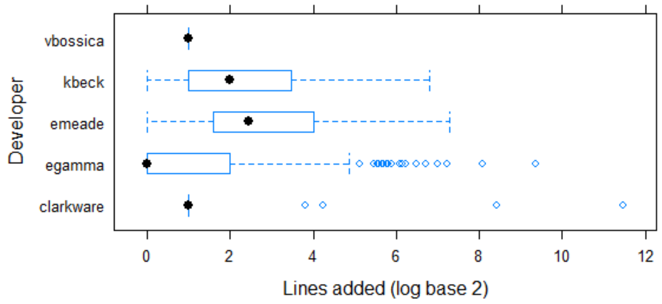
Density Graph of lines added per developer



JUnit

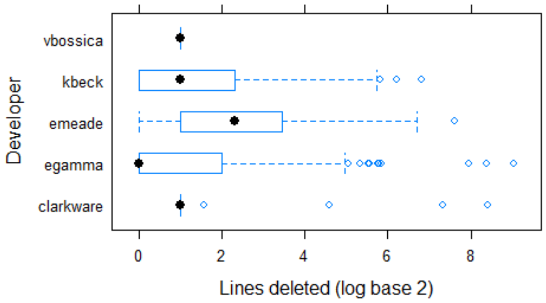
On the JUnit project commits mostly happen at around 15:00 and between 23:00 and 01:00. Most of the activity happens on sundays.

Developer to lines added ratio



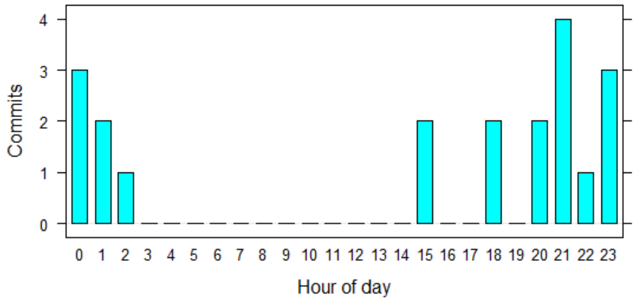
JUnit

Developer to lines deleted ratio



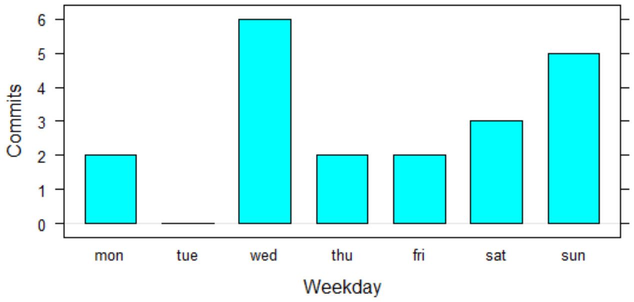
JUnit

Dev commits across daily hours



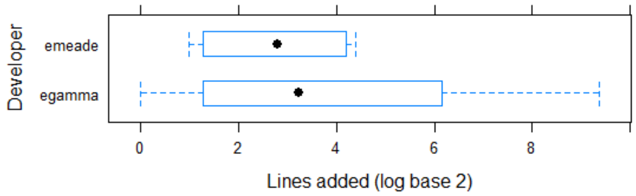
JUnit20

Dev commits per weekday



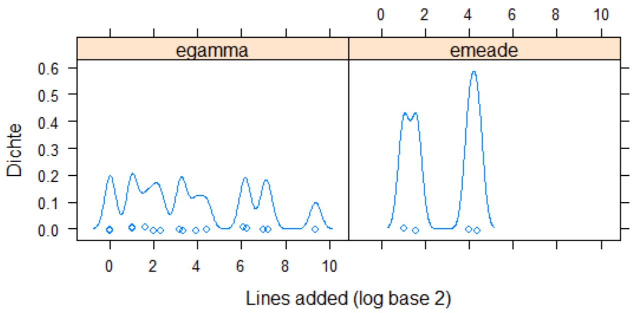
JUnit20

Developer to lines added ratio



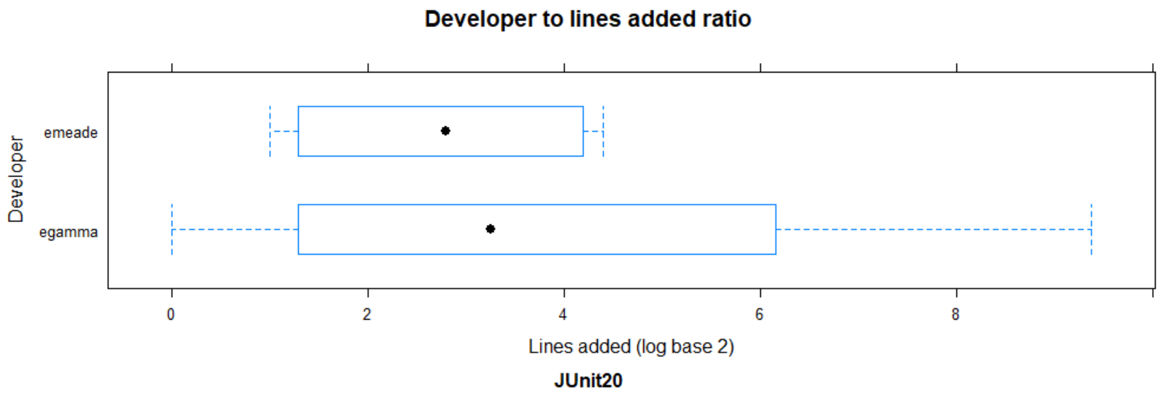
JUnit20

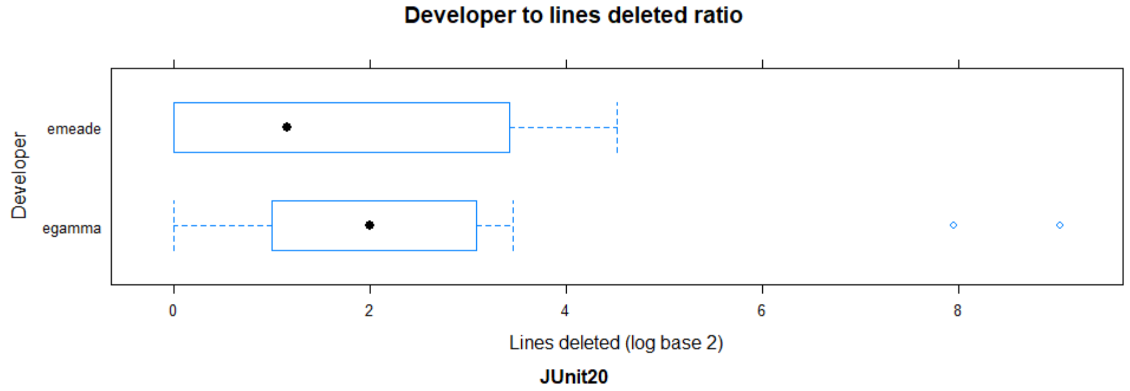
Density Graph of lines added per developer



JUnit20

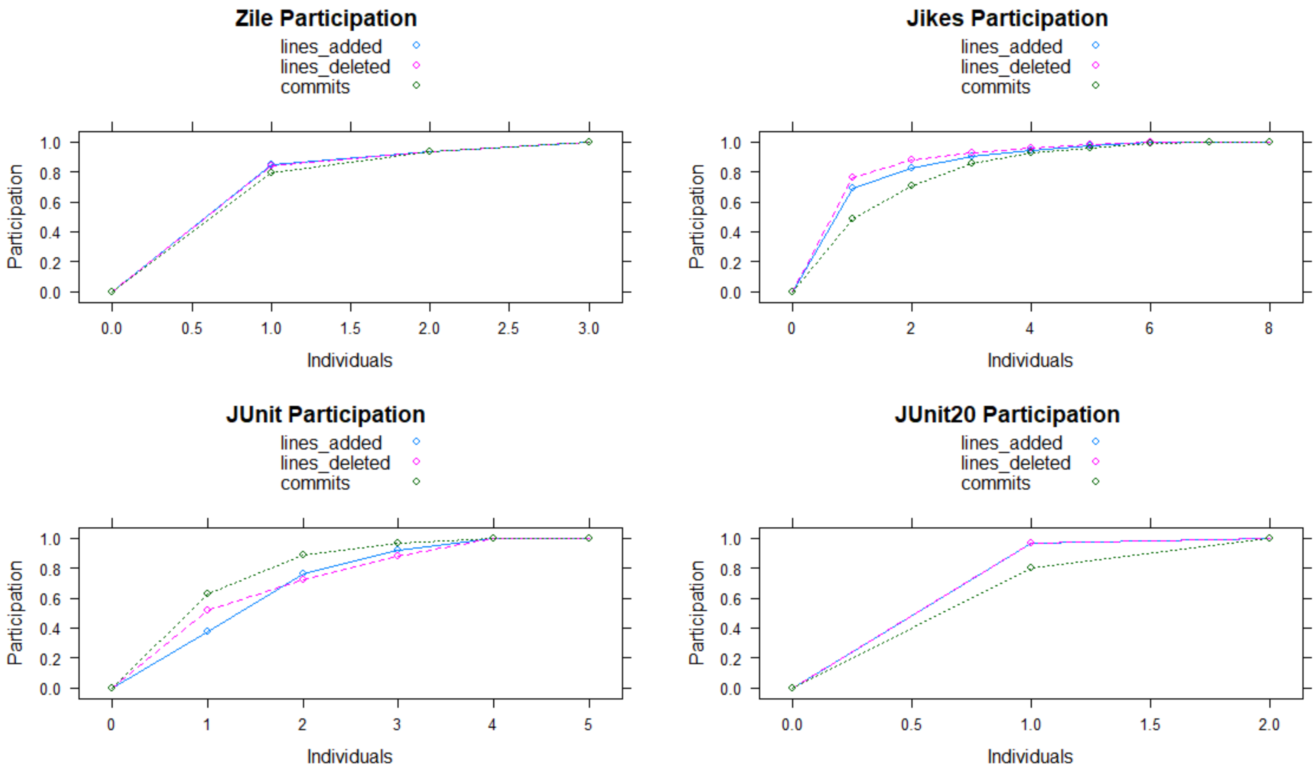
Since this dataset is mostly about one developer who has more than 80% of contributions, we are seeing the development behaviour of this one developer [egamma] (for this project). They seem to work on this project every weekday except for tuesdays (0 commits). Commits happen strictly between 15:00 and 2:00 (with breaks between 16-18 and on 19-20).





1(d)

(d) Participation plots



How to get all plots in one image (window):

```
> myplot.participation.test()
```

We can see on zile that ~80% of contributions (lines added, deleted and commit count) was done by just one developer which we can classify as lead developer(?).

For Jikes, which has the highest individual count (8), we see that the lead developer amounts for ~70% of lines added and deleted, but only 45% of commits. So we can conclude that many of the remaining contributors have worked on small issues and minor changes while the first 3 devs are working on over 80% of the codebase and 90% of the lines added and deleted.

JUnit has the highest diversity in participation: The lead developer has the highest commit count (over 60%), but only amounts for less than 50% of lines added and just above 50% of lines deleted. But even in this case the two most active devs have over 80% total contribution and slightly over 70% of lines added and deleted. So ~30% of devs amount for over 70% of the work.

Junit20 is a very small sample size compared to the other projects and it basically looks like it's a single developer doing over 80% of the work.

Interpretation of all results: From the given open source projects we can conclude that the most active 1-3 developers in a project amount for at least 70% of the work being done. This is true for commit count, total lines added and total lines deleted. However given the small sample size (4 projects) and also the small amount of developers (4.5 on avg, minimum of 2 and maximum of 8) we don't know if this would be true for bigger oss projects (in terms of dev count).