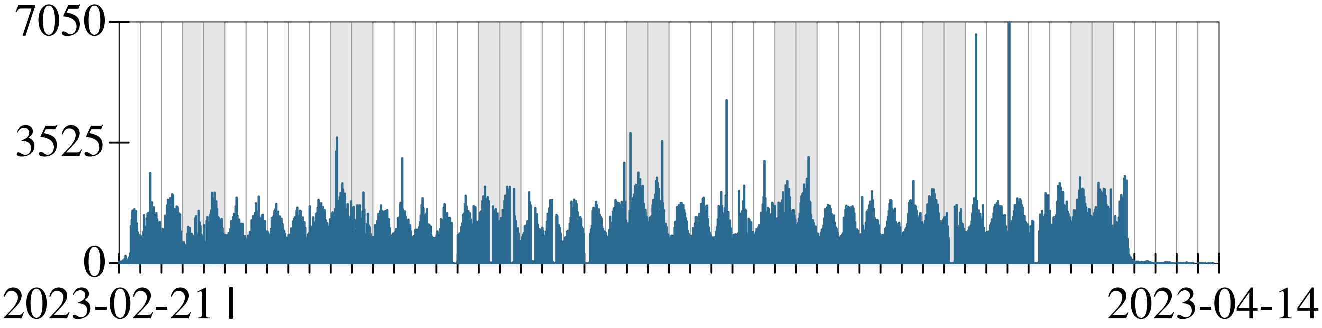
## Figure 3: Records per Hour

Plot from `code/row-distribution.rkt`, which uses the dataset `out/row-distribution.rktd`, which comes from running `prepare.rkt --mode main`.



Lines 1-2 of `out/overview.txt` (output of `prepare.rkt --mode main`) give the reason for sending:

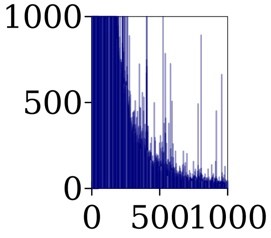
```
 1504736 total logs = 1341348 nocheck + 156883 nonstrict + 6505 strict
  508572 due to module switch
```

## Table 2: Size of Analyzed Code

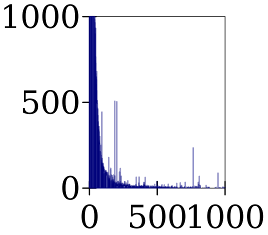
From `out/summary-of-size-distributions.rktd`,
which is the output of `code/sdupdate.rkt`
on `out/size-distributions.rktd`:

```
#hash((editrange . (1156036 926 3007043/817 30975.40553032358 (0.95 8220) (0.96 9858) (0.97 13656) (0.98 18956) (0.99 34725)))
      (event-count . (6079 138 38689/135 582.5752201972966 (0.95 960) (0.96 1174) (0.97 1304) (0.98 1836) (0.99 3302)))
      (files . (54884 7678 55257996/4639 11853.650098459446 (0.95 40029) (0.96 42771) (0.97 45417) (0.98 48688) (0.99 51761)))
      (lines . (1089963 3115 38928947/5992 22364.75846303099 (0.95 18561) (0.96 25892) (0.97 27014) (0.98 29725) (0.99 50547)))
      (timespan . (1387897376 845648 591343604248/185705 15724745.722577972 (0.95 10696064) (0.96 12715468) (0.97 15596940) (0.98 2
```

**Lines:**



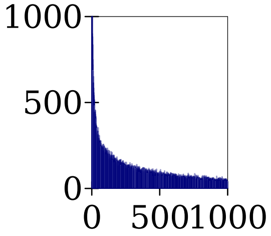
**Edit Range:**



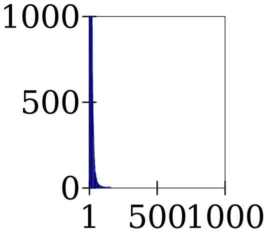
## Table 3: Session Size

See previous section for mean, stddev, median, and P99.

**Timespan:**



**Event Count / Record Count:**



## Table 4: Current Type Errors and Background Errors

Lines 3-8 of `out/overview.txt`:

```
 72235735 total forced strict type errors, 37027281 in module,
 curr 1111178 in edit regions,
 olde 938500 in edit regions
 595137 total type errors, 289698 in module,
 curr 14917 non-stx + 16007 syntax in edit regions,
 olde 13836 non-stx + 28565 syntax in edit regions
```

Current errors in edit range = (14917 + 16007) = 30924

## Figure 4: Overview of Type Analysis Modes

Line 1 of `out/overview.txt` partitions logs by mode:

```
 1504736 total logs = 1341348 nocheck + 156883 nonstrict + 6505 strict
```

Lines 9-13 of `out/overview.txt` partition sessions and report on upgrades and downgrades, *but* the final two numbers are incorrect (upgrade and downgrade) because they include data from module switches:

```
 347598 sessions
  346956 single mode = 313509 nocheck + 32902 nonstrict + 545 strict
  512 multi mode projects
  341 mode upgrades
  320 mode downgrades
```

There are 642 = (347598 - 346956) multi-mode sessions.

Correct up/down-grade numbers are in `out/downgrade-count.txt`, which is the output of `code/downgrade-count.rkt` after running the following commands to generate data:

```
PLTSTDERR="error info@luau" racket prepare.rkt --mode divide-sessions
PLTSTDERR="error info@luau" racket prepare.rkt --mode session-query
PLTSTDERR="error info@luau" racket prepare.rkt --mode aggregate-te
```

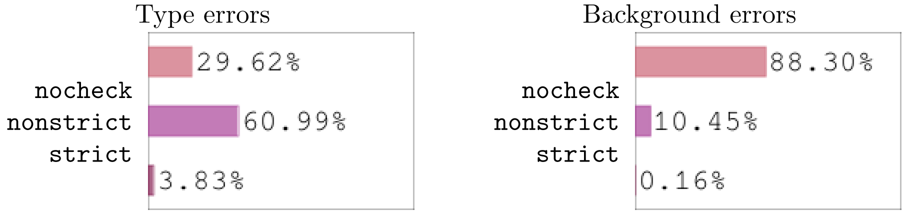
Output:

```
upgrade
245 total sessions
87 with upgrade
#hash(((strict nocheck) . 55)
      (nonstrict . 0)
      ((nonstrict nocheck) . 14)
      (strict . 0)
      (nocheck . 0)
      ((strict nonstrict) . 18))
 (strict nocheck) : 63.22\%
 nonstrict : 0.00\%
 (nonstrict nocheck) : 16.09\%
 strict : 0.00\%
 nocheck : 0.00\%
 (strict nonstrict) : 20.69\%
downgrade
579 total sessions
233 with downgrade
#hash(((strict nocheck) . 116)
      (nonstrict . 0)
      ((nonstrict nocheck) . 64)
      (strict . 0)
      (nocheck . 0)
      ((strict nonstrict) . 53))
 (strict nocheck) : 49.79\%
 nonstrict : 0.00\%
```

```
(nonstrict nocheck) : 27.47\%
strict : 0.00\%
nocheck : 0.00\%
(strict nonstrict) : 22.75\%
```

## Figure 5: Type and Background Errors Grouped by Mode

These plots come from `code/error-by-mode.rkt`, which uses hard-coded data from `out/overview.txt`:



## Table 5: Specific Errors in Edit Range

Output from `code/type-error-survival.rkt` run on `code/type-error-survival-ss-*.rktd` and then sorted alphabetically:

| | nocheck | | | nonstrict | | | strict | | |
|---|---|---|---|---|---|---|---|---|---|
| | Ad | Kee | Drop | Ad | Kee | Drop | Ad | Kee | Drop |
| CannotCallNonFunction | 0 | 0 | 0 | 12 | 2 | 13 | 1 | 0 | 1 |
| CannotExtendTable | 0 | 0 | 0 | 6 | 8 | 1 | 0 | 0 | 1 |
| CannotInferBinaryOperation | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 6 | 6 |
| CountMismatch | 0 | 0 | 0 | 184 | 42 | 157 | 9 | 2 | 9 |
| DuplicateTypeDefinition | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| ExtraInformation | 0 | 0 | 0 | 46 | 6 | 33 | 1 | 0 | 1 |
| FunctionDoesNotTakeSelf | 0 | 0 | 0 | 3 | 4 | 1 | 0 | 0 | 0 |
| FunctionExitsWithoutReturning | 0 | 0 | 0 | 6 | 1 | 5 | 7 | 3 | 5 |
| GenericError | 0 | 0 | 0 | 177 | 47 | 149 | 5 | 0 | 8 |
| IllegalRequire | 0 | 0 | 0 | 7 | 1 | 11 | 0 | 0 | 0 |
| IncorrectGenericParameterCount | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| MissingProperties | 0 | 0 | 0 | 8 | 3 | 6 | 5 | 3 | 3 |
| ModuleHasCyclicDependency | 0 | 0 | 0 | 9 | 5 | 8 | 0 | 0 | 0 |
| NotATable | 0 | 0 | 0 | 4 | 1 | 5 | 2 | 0 | 1 |
| OccursCheckFailed | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| OnlyTablesCanHaveMethods | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| OptionalValueAccess | 0 | 0 | 0 | 21 | 45 | 15 | 4 | 2 | 4 |
| SyntaxError | 0 | 0 | 8290 | 0 | 0 | 1149 | 0 | 0 | 29 |
| TypeMismatch | 0 | 0 | 0 | 103 | 51 | 80 | 13 | 6 | 18 |
| UnknownPropButFoundLikeProp | 0 | 0 | 0 | 20 | 17 | 13 | 0 | 0 | 0 |
| UnknownProperty | 0 | 0 | 0 | 256 | 156 | 208 | 16 | 18 | 22 |
| UnknownRequire | 0 | 0 | 0 | 43 | 30 | 37 | 5 | 3 | 3 |
| UnknownSymbol | 0 | 0 | 0 | 1992 | 438 | 1797 | 38 | 18 | 35 |

## Table 6: Type Error Popularity

Output from `code/type-error-count.rkt` run on `code/te-editrange-ss-*.rktd`.

This script produces output for all three modes: `nocheck`, `nonstrict`, and `strict`. The paper combines `nonstrict` and `strict` into one table.

### `nocheck`

unused code IllegalRequire unused code UnknownSymbol unused code TypeMismatch unused code NormalizationTooComplex unused code DynamicPropertyLookupOnClassesUnsafe unused code MissingUnionProperty unused code UnknownProperty unused code TypePackMismatch unused code DuplicateTypeDefinition unused code UnknownRequire unused code TypesAreUnrelated unused code MissingProperties unused code FunctionExitsWithoutReturning unused code CannotExtendTable unused code FunctionDoesNotTakeSelf unused code UnificationTooComplex unused code GenericError unused code NotATable unused code OnlyTablesCanHaveMethods unused code CodeTooComplex unused code InternalError unused code FunctionRequiresSelf unused code UnknownPropButFoundLikeProp unused code CannotInferBinaryOperation unused code IncorrectGenericParameterCount unused code OptionalValueAccess unused code DuplicateGenericParameter unused code CountMismatch unused code OccursCheckFailed unused code DeprecatedApiUsed unused code CannotCallNonFunction unused code ModuleHasCyclicDependency unused code SwappedGenericTypeParameter unused code ExtraInformation NEVER APPEAR: (IllegalRequire UnknownSymbol TypeMismatch NormalizationTooComplex DynamicPropertyLookupOnClassesUnsafe MissingUnionProperty UnknownProperty TypePackMismatch DuplicateTypeDefinition UnknownRequire TypesAreUnrelated MissingProperties FunctionExitsWithoutReturning CannotExtendTable FunctionDoesNotTakeSelf UnificationTooComplex GenericError NotATable OnlyTablesCanHaveMethods CodeTooComplex InternalError FunctionRequiresSelf UnknownPropButFoundLikeProp CannotInferBinaryOperation IncorrectGenericParameterCount OptionalValueAccess DuplicateGenericParameter CountMismatch OccursCheckFailed DeprecatedApiUsed CannotCallNonFunction ModuleHasCyclicDependency SwappedGenericTypeParameter ExtraInformation)

| | |
|---|---|
| `SyntaxError` | 100.00 % |

`nonstrict`

unused code NormalizationTooComplex unused code DynamicPropertyLookupOnClassesUnsafe unused code TypePackMismatch unused code UnificationTooComplex unused code CodeTooComplex unused code InternalError unused code FunctionRequiresSelf unused code IncorrectGenericParameterCount unused code DuplicateGenericParameter unused code OccursCheckFailed unused code DeprecatedApiUsed unused code SwappedGenericTypeParameter NEVER APPEAR: (NormalizationTooComplex DynamicPropertyLookupOnClassesUnsafe TypePackMismatch UnificationTooComplex CodeTooComplex InternalError FunctionRequiresSelf IncorrectGenericParameterCount DuplicateGenericParameter OccursCheckFailed DeprecatedApiUsed SwappedGenericTypeParameter)

| | |
|---|---:|
| `UnknownSymbol` | 62.13 % |
| `SyntaxError` | 15.42 % |
| `UnknownProperty` | 8.28 % |
| `UnknownRequire` | 3.13 % |
| `TypeMismatch` | 2.44 % |
| `CountMismatch` | 2.26 % |
| `OptionalValueAccess` | 2.07 % |
| `GenericError` | 2.06 % |
| `UnknownPropButFoundLikeProp` | 0.44 % |
| `CannotExtendTable` | 0.42 % |
| `ExtraInformation` | 0.32 % |
| `ModuleHasCyclicDependency` | 0.23 % |
| `IllegalRequire` | 0.20 % |
| `NotATable` | 0.15 % |
| `CannotCallNonFunction` | 0.15 % |
| `MissingProperties` | 0.09 % |
| `FunctionExitsWithoutReturning` | 0.07 % |
| `FunctionDoesNotTakeSelf` | 0.07 % |
| `MissingUnionProperty` | 0.02 % |
| `CannotInferBinaryOperation` | 0.02 % |
| `OnlyTablesCanHaveMethods` | 0.01 % |
| `DuplicateTypeDefinition` | 0.00 % |
| `TypesAreUnrelated` | 0.00 % |

`strict`

unused code NormalizationTooComplex unused code DynamicPropertyLookupOnClassesUnsafe unused code MissingUnionProperty unused code TypePackMismatch unused code DuplicateTypeDefinition unused code FunctionDoesNotTakeSelf unused code UnificationTooComplex unused code OnlyTablesCanHaveMethods unused code CodeTooComplex unused code InternalError unused code FunctionRequiresSelf unused code DuplicateGenericParameter unused code DeprecatedApiUsed unused code SwappedGenericTypeParameter NEVER APPEAR: (NormalizationTooComplex DynamicPropertyLookupOnClassesUnsafe MissingUnionProperty TypePackMismatch DuplicateTypeDefinition FunctionDoesNotTakeSelf UnificationTooComplex OnlyTablesCanHaveMethods CodeTooComplex InternalError FunctionRequiresSelf DuplicateGenericParameter DeprecatedApiUsed SwappedGenericTypeParameter)

| | |
|---|---|
| `UnknownSymbol` | 23.97 % |
| `TypeMismatch` | 20.46 % |
| `UnknownProperty` | 18.88 % |
| `SyntaxError` | 9.31 % |
| `CannotInferBinaryOperation` | 6.94 % |
| `MissingProperties` | 4.04 % |
| `FunctionExitsWithoutReturning` | 2.99 % |
| `OptionalValueAccess` | 2.99 % |
| `CountMismatch` | 2.99 % |
| `UnknownRequire` | 2.37 % |
| `GenericError` | 2.28 % |
| `NotATable` | 1.32 % |
| `ExtraInformation` | 0.35 % |
| `UnknownPropButFoundLikeProp` | 0.26 % |
| `IllegalRequire` | 0.18 % |
| `IncorrectGenericParameterCount` | 0.18 % |
| `CannotCallNonFunction` | 0.18 % |
| `TypesAreUnrelated` | 0.09 % |
| `CannotExtendTable` | 0.09 % |
| `OccursCheckFailed` | 0.09 % |
| `ModuleHasCyclicDependency` | 0.09 % |

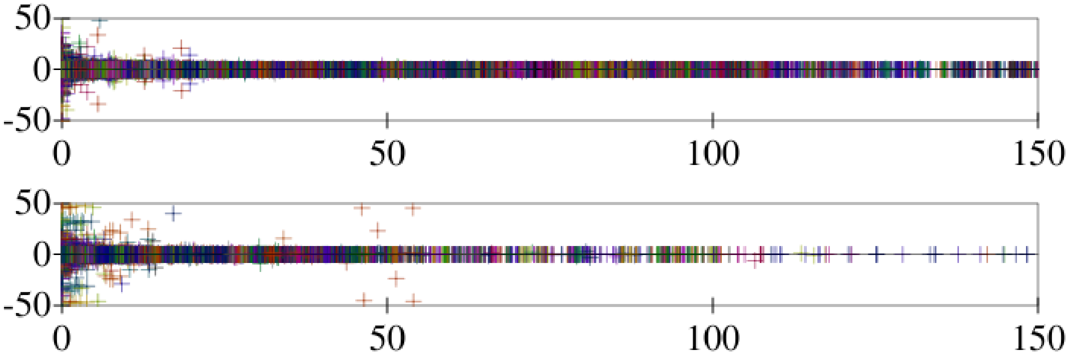
### Internal Limits, Code Too Complex

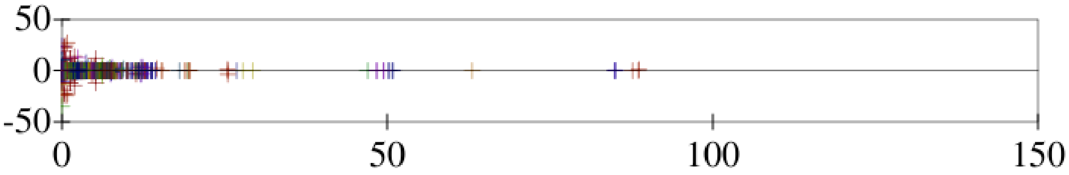
Data from `out/ctc-info.txt`, which comes from `prepare.rkt --mode main`:

```
(980,835,567,637,391 #<datetime 2023-03-30T17:27:22.322> #<datetime 2023-03-30T17:28:06.924> nonstrict 2)
(607,632,332,499,626 #<datetime 2023-04-02T17:53:33.696> #<datetime 2023-04-02T17:53:57.424> nonstrict 4)
(607,632,332,499,626 #<datetime 2023-04-03T11:16:50.068> #<datetime 2023-04-03T11:17:13.453> nonstrict 4)
(315,096,293,918,073 #<datetime 2023-04-08T23:54:22.135> #<datetime 2023-04-08T23:54:50.46> nonstrict 2)
(315,096,293,918,073 #<datetime 2023-04-08T23:02:03.668> #<datetime 2023-04-08T23:02:49.4> nonstrict 2)
(315,096,293,918,073 #<datetime 2023-04-08T22:52:43.752> #<datetime 2023-04-08T22:52:48.791> nonstrict 2)
(315,096,293,918,073 #<datetime 2023-04-08T22:44:56.671> #<datetime 2023-04-08T22:45:48.586> nonstrict 2)
(315,096,293,918,073 #<datetime 2023-04-08T22:44:03.375> #<datetime 2023-04-08T22:44:48.676> nonstrict 2)
(315,096,293,918,073 #<datetime 2023-04-08T22:42:32.045> #<datetime 2023-04-08T22:42:48.557> nonstrict 2)
(315,096,293,918,073 #<datetime 2023-04-08T22:42:32.91> #<datetime 2023-04-08T22:42:48.557> nonstrict 2)
(315,096,293,918,073 #<datetime 2023-04-08T22:41:44.628> #<datetime 2023-04-08T22:41:48.527> nonstrict 2)
```

## Figure 6: Type Error Density

Plot output from `code/error-count.rkt` on `out/error-density-ss-*.rktd`. (It also prints text output.):





## Figure 7: Edits and Number of Errors

From reordered text output from `code/error-count.rkt` on `out/error-density-ss-*.rktd`. Here is the raw, unsorted output:

```
TE
  nocheck & 48378 & (\pct{46.83}) & 9440 & [\pct{9.14}] & 45479 & [\pct{44.03}] \\
FS
  nocheck & 270763 & (\pct{36.99}) & 238696 & [\pct{32.61}] & 222588 & [\pct{30.41}] \\
TE mod
  nocheck & 20085 & (\pct{49.83}) & 906 & [\pct{2.25}] & 19317 & [\pct{47.92}] \\
FS mod
  nocheck & 259865 & (\pct{39.09}) & 175643 & [\pct{26.42}] & 229271 & [\pct{34.49}] \\
TE
  nonstrict & 19491 & (\pct{39.63}) & 9567 & [\pct{19.45}] & 20121 & [\pct{40.91}] \\
FS
  nonstrict & 35330 & (\pct{37.28}) & 29483 & [\pct{31.11}] & 29955 & [\pct{31.61}] \\
TE mod
  nonstrict & 13030 & (\pct{40.22}) & 5513 & [\pct{17.02}] & 13852 & [\pct{42.76}] \\
FS mod
  nonstrict & 33988 & (\pct{39.74}) & 20738 & [\pct{24.25}] & 30798 & [\pct{36.01}] \\
TE
  strict & 733 & (\pct{39.18}) & 368 & [\pct{19.67}] & 770 & [\pct{41.15}] \\
FS
  strict & 574 & (\pct{33.71}) & 561 & [\pct{32.94}] & 568 & [\pct{33.35}] \\
TE mod
  strict & 419 & (\pct{39.31}) & 230 & [\pct{21.58}] & 417 & [\pct{39.12}] \\
FS mod
  strict & 488 & (\pct{36.53}) & 344 & [\pct{25.75}] & 504 & [\pct{37.72}] \\
```