CSC343
Project Presentation

TTC Delays

Domain

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- The domain of our project is recorded delay instances for three types of TTC vehicles (buses, streetcars, and trains) along with monthly ridership and revenue for the TTC.
- Due to size of the data, we limited TTC delay data to the months of April, May, June of 2020. TTC ridership and revenue data spans from Oct 2018 to Sept 2020.

Results

———

Which months of the year have the most delays and how does this affect TTC ridership and revenue?

- We took a small sample size from April to June due to the volume of data.
- Initial hypothesis: April would have more ridership and revenue compared to summer months.
- As delays increase, ridership and revenue decrease.

Results

———

- From April to June, delays, ridership and revenue.
- Possible reason: COVID19 lockdown occurred in April reducing TTC usage and possibly shutting down TTC routes.
- As lockdown restrictions ended, ridership and revenue increased. Usage increased resulting in more delays.

month	year	delaycount	ridership	revenue
4	2020	791	205000	13663000
5	2020	1201	263000	14087000
6	2020	3910	345000	24823000

Results

———

What type of vehicle is the most susceptible to delays (the least amount of days on average between mechanical delays for the same vehicle)?

- We had initially thought buses, but the results show that all TTC vehicle types are virtually the same!

```
  type    |        avg
----------+------------------
train     | 13.9883879781434
streetcar |  13.988387978142
bus       | 13.9883879781435
```

Evolution

———

- Phase 1 schema changes:
- 1st: One big delay relation for all vehicle types

```
┌─────────────────┐
│                 │
│     Delays      │
│                 │
└─────────────────┘
```

Evolution

———

- Phase 1 schema changes:
- 2nd: Three different, disconnected delay relations for each vehicle type
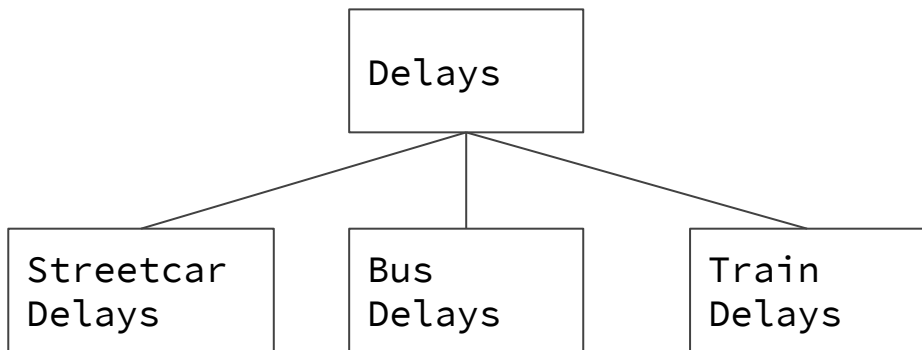
```
Streetcar
Delays
```

```
Bus
Delays
```

```
Train
Delays
```

Evolution

———

- Phase 1 schema changes:
- Final: Three different delay relations for each vehicle type that references one master delay relation

```
                    ┌──────────┐
                    │ Delays   │
                    │          │
                    └──────────┘
                   ╱     │     ╲
                  ╱      │      ╲
        ┌──────────┐ ┌──────────┐ ┌──────────┐
        │ Streetcar│ │ Bus      │ │ Train    │
        │ Delays   │ │ Delays   │ │ Delays   │
        └──────────┘ └──────────┘ └──────────┘
```

Lessons

———

- Importance of splitting relations to avoid irrelevant attributes
- Try to make relations as specific as possible to its data while still conveying all the relevant information
- View relations as parents and children / hierarchical

```
                    ┌──────────┐
                    │ Delays   │
                    │          │
                    └──────────┘
              ╱           │           ╲
    ┌──────────┐    ┌──────────┐    ┌──────────┐
    │ Streetcar│    │ Bus      │    │ Train    │
    │ Delays   │    │ Delays   │    │ Delays   │
    └──────────┘    └──────────┘    └──────────┘
```
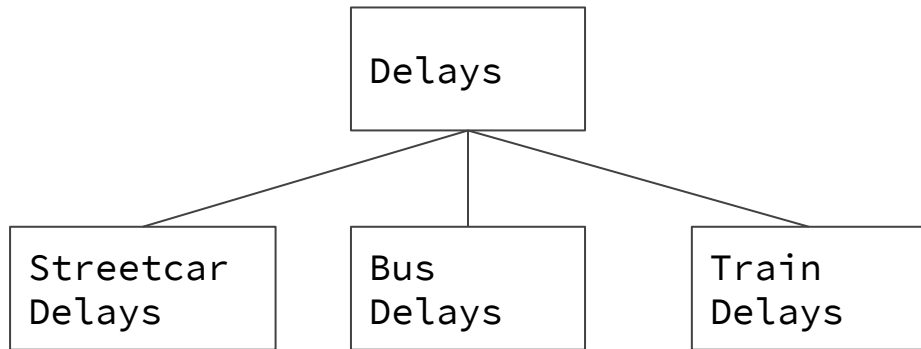
Lessons

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- Understanding the domain is critical to:
- Building an appropriate schema.
  - Ex. Understanding that vehicle types are unique and can be assigned key values.
- Cleansing data and interpreting results.
  - Ex. Understanding the descriptions and categories of delays to interpret the results of queries.

Questions?

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Game

Which buses by route are the worst relative to delays?

- **Game:** How bad is your bus route really?

```
worst_rating | route | num_delays |      avg_delay
-------------+-------+------------+---------------------
          88 |     1 |          9 |    2.1111111111111111
         114 |     5 |          4 |   17.5000000000000000
          38 |     6 |         24 |   23.7083333333333333
          13 |     7 |         54 |   14.5000000000000000
         109 |     8 |          4 |   18.7500000000000000
         101 |     9 |          6 |   22.8333333333333333
          21 |    11 |         42 |   17.0952380952380952
          56 |    12 |         14 |   38.4285714285714286
         106 |    14 |          5 |   58.4000000000000000
          99 |    15 |          6 |   20.8333333333333333
          33 |    16 |         32 |   32.1875000000000000
          30 |    17 |         32 |   13.9062500000000000
          61 |    20 |         13 |   38.4615384615384615
          42 |    21 |         21 |   16.7619047619047619
          50 |    22 |         16 |   10.7500000000000000
          70 |    23 |         11 |   19.1818181818181818
          34 |    24 |         31 |   14.3548387096774194
          40 |    25 |         23 |    8.7391304347826087
         108 |    26 |          5 |   31.0000000000000000
           7 |    29 |         68 |   10.9852941176470588
         116 |    31 |          4 |   47.2500000000000000
           3 |    32 |        118 |   11.2796610169491525
         131 |    33 |          2 |   30.0000000000000000
          24 |    34 |         39 |   11.4615384615384615
          17 |    35 |         49 |    8.0408163265306122
           4 |    36 |        114 |   16.7280701754385965
          75 |    37 |         11 |   17.7272727272727273
          26 |    38 |         37 |    7.6756756756756757
          16 |    39 |         52 |   15.0769230769230769
          51 |    40 |         16 |   45.7500000000000000
          23 |    41 |         39 |   19.6410256410256410
          48 |    42 |         17 |   12.6470588235294118
          22 |    43 |         40 |   13.0500000000000000
          60 |    44 |         13 |    6.3076923076923077
          77 |    45 |         10 |   14.2000000000000000
          55 |    46 |         14 |   15.8571428571428571
          28 |    47 |         34 |   15.3823529411764706
         156 |    48 |          1 |   17.0000000000000000
         138 |    49 |          2 |   12.5000000000000000
         105 |    50 |          5 |   12.4000000000000000
          62 |    51 |         13 |   41.2307692307692308
           2 |    52 |        129 |   19.3798449612403101
           8 |    53 |         61 |   11.7377049180327869
           5 |    54 |         75 |   13.4533333333333333
         148 |    55 |          1 |   30.0000000000000000
          68 |    56 |         12 |   20.0833333333333333
          37 |    57 |         25 |    7.6400000000000000
          93 |    59 |          8 |   40.2500000000000000
           9 |    60 |         59 |   10.3559322033898305
          89 |    61 |          9 |   38.0000000000000000
          97 |    62 |          7 |  115.0000000000000000
          10 |    63 |         59 |    8.6440677966101695
         162 |    64 |          1 |   10.0000000000000000
         122 |    65 |          3 |   13.6666666666666667
         107 |    66 |          5 |   17.0000000000000000
          82 |    67 |         10 |   52.3000000000000000
          72 |    68 |         11 |   22.4545454545454545
          66 |    69 |         12 |   30.8333333333333333
          63 |    70 |         13 |   17.0000000000000000
          85 |    71 |          9 |   12.3333333333333333
          69 |    72 |         12 |   16.0833333333333333
          52 |    73 |         15 |   19.2000000000000000
          84 |    74 |          9 |   18.5555555555555556
          18 |    75 |         47 |   42.2765957446808511
          54 |    76 |         15 |    8.7333333333333333
         125 |    77 |          3 |   10.0000000000000000
         118 |    78 |          4 |   12.5000000000000000
          44 |    79 |         20 |   15.0500000000000000
          86 |    80 |          9 |   17.6666666666666667
         102 |    81 |          6 |    9.8333333333333333
         137 |    82 |          2 |   29.0000000000000000
         124 |    83 |          3 |   16.3333333333333333
          25 |    84 |         38 |   12.1578947368421053
          11 |    85 |         56 |   18.4464285714285714
          32 |    86 |         32 |   12.7812500000000000
          47 |    87 |         18 |   13.1666666666666667
          74 |    88 |         11 |   14.4545454545454545
          27 |    89 |         36 |   11.6666666666666667
```

164 bus routes total!

```
  78 |  90 |  10 |   9.4000000000000000
  90 |  91 |   8 |  17.8750000000000000
 104 |  92 |   6 |  38.1666666666666667
 134 |  93 |   2 |  32.0000000000000000
  41 |  94 |  22 |  18.2272727272727273
  12 |  95 |  55 |   8.5272727272727273
  29 |  96 |  33 |  21.1515151515151515
  49 |  97 |  17 |  52.7647058823529412
  79 |  98 |  10 |  23.4000000000000000
  57 | 100 |  14 |   7.5714285714285714
 132 | 101 |   2 |  15.5000000000000000
  14 | 102 |  54 |  13.6851851851851852
 113 | 104 |   4 |  14.0000000000000000
  87 | 105 |   9 |  13.4444444444444444
  39 | 106 |  24 |  11.0833333333333333
 103 | 107 |   6 |  39.6666666666666667
  45 | 108 |  19 |  20.0526315789473684
  71 | 109 |  11 |  56.7272727272727273
  59 | 110 |  13 |  15.3846153846153846
  94 | 112 |   8 |  20.5000000000000000
  65 | 113 |  12 |  20.4166666666666667
  20 | 116 |  46 |  12.4130434782608696
  76 | 117 |  10 |  55.2000000000000000
 117 | 118 |   4 |  30.0000000000000000
 164 | 119 |   1 |  25.0000000000000000
  91 | 120 |   8 | 192.0000000000000000
  67 | 121 |  12 |  58.7500000000000000
  64 | 122 |  12 |  14.8333333333333333
  98 | 123 |   7 |  18.0000000000000000
  53 | 124 |  15 |  10.0666666666666667
 110 | 125 |   4 |  15.0000000000000000
  95 | 126 |   7 |  22.0000000000000000
 121 | 127 |   3 |  49.0000000000000000
  43 | 129 |  21 |   9.5714285714285714
 119 | 130 |   4 |  68.2500000000000000
  73 | 131 |  11 |   8.0000000000000000
 128 | 132 |   3 |  17.0000000000000000
   1 | 133 | 190 |  10.2578947368421053
  80 | 134 |  10 |  17.2000000000000000
  96 | 135 |   7 |  42.0000000000000000
```

```
 111 | 160 |   4 |  18.2500000000000000
  36 | 161 |  28 |  28.3571428571428571
 135 | 162 |   2 |  30.0000000000000000
  35 | 163 |  29 |  11.4827586206896552
  19 | 165 |  47 |  27.6595744680851064
 142 | 167 |   2 |  18.5000000000000000
  58 | 168 |  13 |  11.3076923076923077
 140 | 169 |   2 |  30.0000000000000000
 127 | 171 |   3 |  20.0000000000000000
 141 | 189 |   2 |  30.0000000000000000
  46 | 300 |  19 |  18.5789473684210526
  83 | 307 |   9 |  36.0000000000000000
 154 | 312 |   1 |  30.0000000000000000
 144 | 315 |   1 |  30.0000000000000000
  31 | 320 |  32 |   5.7187500000000000
 152 | 322 |   1 |  30.0000000000000000
 126 | 324 |   3 |  20.0000000000000000
 161 | 325 |   1 |  30.0000000000000000
 151 | 329 |   1 |  30.0000000000000000
 120 | 332 |   3 |  30.0000000000000000
 149 | 334 |   1 |  30.0000000000000000
 143 | 335 |   1 |  30.0000000000000000
 146 | 339 |   1 |  30.0000000000000000
 133 | 341 |   2 |  30.0000000000000000
 155 | 343 |   1 |  30.0000000000000000
 129 | 353 |   3 |  19.3333333333333333
 136 | 354 |   2 |  30.0000000000000000
 115 | 395 |   4 |  30.0000000000000000
 158 | 396 |   1 | 106.0000000000000000
 139 | 501 |   2 |  18.0000000000000000
 112 | 506 |   4 |   4.7500000000000000
 123 | 511 |   3 |   5.0000000000000000
   6 | 600 |  74 |   1.9729729729729730
 150 | 601 |   1 |   1.0000000000000000
 163 | 711 |   1 |   1.0000000000000000
 159 | 719 |   1 |   1.0000000000000000
  81 | 900 |  10 |  10.2000000000000000
 145 | 902 |   1 |  10.0000000000000000
 157 | 905 |   1 |  12.0000000000000000
 160 | 925 |   1 |   1.0000000000000000
```

164 bus routes total!