Analysis of Wildlife Strikes to Aircraft

Practicum I CS5200

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Installing all required packages

```
## -- Attaching core tidyverse packages ----------------------- tidyverse 2.0.0 --
## v dplyr     1.1.4      v readr     2.1.5
## v forcats   1.0.0      v stringr   1.5.1
## v ggplot2   3.5.0      v tibble    3.2.1
## v lubridate 1.9.3      v tidyr     1.3.1
## v purrr     1.0.2
## -- Conflicts ------------------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
## Loading required package: gsubfn
##
## Loading required package: proto
##
## Loading required package: RSQLite
##
## hash-2.2.6.3 provided by Decision Patterns
##
##
##
## Attaching package: 'RMySQL'
##
##
## The following object is masked from 'package:RSQLite':
##
##     isIdCurrent
```

connecting to the cloud database hosted on gcloud

set constraint FK and drop tables

```
## [1] 0
```

```
## [1] 0
```

```
## [1] 0
```

```
## [1] 0
```

```
## [1] 0
```

create new tables

```
## [1] 0
```

```
## [1] 0
```

```
## [1] 0
```

```
## [1] 0
```

```
## [1] 0
```

check the table info

read the csv data file

```
##  [1] "rid"            "flight_date"   "aircraft"       "airline"
##  [5] "airport"        "impact"        "damage"         "origin"
##  [9] "sky_conditions" "altitude_ft"   "heavy_flag"
```

find the unique sky conditions to add in the table

```
##     sky_conditions
## 1         No Cloud
## 2       Some Cloud
## 13        Overcast
```

insert data into conditions table

```
## [1] 3
```

insert data into airports

```
## [1] TRUE
```

insert data into flights table

```
## [1] 0
```

```
## [1] 0
```

```
## [1] TRUE
```

```
## [1] 0
```

```
## [1] 0
```

```
## [1] 0
```

```
## [1] TRUE
```

```
## [1] 0
```

```
## [1] 0
```

```
## [1] TRUE
```

insert data into strikes table

```
## [1] 0
```

```
## [1] 0
```

```
## [1] TRUE

## [1] 0

## [1] 0

## [1] TRUE

## [1] 0

## [1] 0

## [1] TRUE
```

Display tables

```
## [1] "Airport table"

##   aid              airportName airportState airportCode
## 1   1              LAGUARDIA NY     New York         ZZZ
## 2   2 DALLAS/FORT WORTH INTL ARPT       Texas         ZZZ
## 3   3          LAKEFRONT AIRPORT    Louisiana         ZZZ
## 4   4        SEATTLE-TACOMA INTL   Washington         ZZZ
## 5   5              NORFOLK INTL     Virginia         ZZZ

## [1] "Flight table"

##    fid month origin airlineName aircraftType isHeavy
## 1 1195    11     43    MILITARY     Airplane       0
## 2 3019    10   7861    MILITARY     Airplane       0
## 3 3500     5     43    MILITARY     Airplane       0
## 4 3504     5     43    MILITARY     Airplane       0
## 5 3597     4    239    MILITARY     Airplane       0

## [1] "conditions table"

##   cid sky_condition explanation
## 1   1      No Cloud     Unknown
## 2   2    Some Cloud     Unknown
## 3   3      Overcast     Unknown

## [1] "strikes table"

##   sid     fid numbirds                 impact damage altitude conditions
## 1   1  202152        0     Engine Shut Down        1     1500          1
## 2   2  208159        0                 None        1        0          2
## 3   3  207601        0                 None        0       50          1
## 4   4  215953        0  Precautionary Landing        0       50          2
## 5   5  219878        0                 None        0       50          1
```

Top Airports with Strikes

```
##          state number_of_incidents
## 1   California                2497
## 2        Texas                2442
## 3      Florida                2041
## 4     New York                1314
## 5 Pennsylvania                 982
## 6     Missouri                 951
## 7     Kentucky                 805
## 8         Ohio                 773
```

```
## 9      Hawaii              716
## 10     Michigan            677
```

Analysis by Airline

```
##                             airline num_incidents
## 1                          MILITARY            89
## 2                           ABX AIR           186
## 3                       AIR MIDWEST            24
## 4           AMERICAN EAGLE AIRLINES           875
## 5                        US AIRWAYS          1327
## 6                   UNITED AIRLINES           471
## 7                  BUSINESS EXPRESS             2
## 8              GREAT LAKES AIRLINES           158
## 9                          BUSINESS          3064
## 10                    FEDEX EXPRESS           276
## 11                      UPS AIRLINES          587
## 12              TRANS WORLD AIRLINES           41
## 13                SOUTHWEST AIRLINES         4618
## 14                   MIDWAY AIRLINES            17
## 15                 AMERICAN AIRLINES          1913
## 16                NORTHWEST AIRLINES           457
## 17                  DELTA AIR LINES          1341
## 18            AMERICA WEST AIRLINES           156
## 19                     MESA AIRLINES           252
## 20                    ALOHA AIRLINES           135
## 21              CONTINENTAL AIRLINES           344
## 22            EXECUTIVE JET AVIATION            50
## 23                  ASTAR AIR CARGO             84
## 24          ATLANTIC COAST AIRLINES           110
## 25                  PRIVATELY OWNED           390
## 26                   ALASKA AIRLINES           304
## 27                  FREEDOM AIRLINES            20
## 28 EXPRESSJET (CONTINENTAL EXPRS)            366
## 29                             CCAIR             8
## 30              AIR TRANSPORT INTL              7
## 31                   MESABA AIRLINES           221
## 32                ATLANTIC SOUTHEAST           338
## 33                      AIR TRANSAT             3
## 34                  SPIRIT AIRLINES           138
## 35                        ISLAND AIR           122
## 36             TRANS STATES AIRLINES            72
## 37                          CAPE AIR            69
## 38                      HAWAIIAN AIR           332
## 39                   COMAIR AIRLINES           317
## 40                  LEGEND AIRLINES             2
## 41                           UNKNOWN            72
## 42                FRONTIER AIRLINES           416
## 43                      PSA AIRLINES           182
## 44             CHAUTAUQUA AIRLINES           184
## 45                        GOVERNMENT           159
## 46                 SKYWEST AIRLINES           864
## 47                       HORIZON AIR           196
## 48                      ATA AIRLINES            28
```

```
## 49                    FLIGHT EXPRESS              18
## 50                   WIGGINS AIRWAYS               5
## 51                   AIRTRAN AIRWAYS             413
## 52                   COLGAN AIRWAYS               62
## 53            AIR WISCONSIN AIRLINES             224
## 54                 EXPRESS ONE INTL               4
## 55                       COMMUTAIR               92
## 56                   AIRNET EXPRESS               19
## 57                  JETBLUE AIRWAYS              704
## 58                VANGUARD AIRLINES               5
## 59                        PINNACLE              379
## 60             SUN COUNTRY AIRLINES               8
## 61                RYAN AIR SERVICES               2
## 62                     AMERIFLIGHT               36
## 63                        ATLAS AIR               17
## 64              AIR CARGO CARRIERS               11
## 65                         PRO AIR                2
## 66                      AIR JAMAICA                6
## 67   US CUSTOMS AND BORDER PROTECTION            16
## 68                 NETJETS AVIATION               32
## 69                PIEDMONT AIRLINES              113
## 70                   OMNI AIR INTL                3
## 71                         BANKAIR                6
## 72                       AIR CANADA               90
## 73                       LUFTHANSA               12
## 74                   CAYMAN AIRWAYS                2
## 75                          PAN AM                3
## 76           CASINO EXPRESS AIRLINES               3
## 77                 MIDWEST AIRLINES               35
## 78             KITTY HAWK AIR CARGO                7
## 79                 ALLEGHENYAIRLINES              31
## 80                 SHUTTLE AMERICA               57
## 81                 MYTRAVEL AIRWAYS                2
## 82              EXECUTIVE JET MGMNT               25
## 83                 USA JET AIRLINES               13
## 84                          PENAIR               12
## 85                   JAPAN AIRLINES               46
## 86          GULFSTREAM INTL AIRLINES              48
## 87          EVERGREEN INTL AIRLINES               5
## 88            TRANSMERIDIAN AIRLINES               4
## 89           PACIFIC ISLAND AVIATION              10
## 90                      FORD MOTOR                4
## 91                  BIGSKY AIRLINES                4
## 92              RYAN INTL AIRLINES               10
## 93                       KOREAN AIR                3
## 94                 EMERY WORLDWIDE                4
## 95               CLAY LACY AVIATION                2
## 96            AMERISTAR JET CHARTER                7
## 97                    AIR SUNSHINE                2
## 98               SOUTHEAST AIRLINES                9
## 99              MID-ATLANTIC FREIGHT               3
## 100                        AVIANCA                3
## 101                 EMPIRE AIRLINES               12
## 102                    AIR GEORGIAN                7
```

```
## 103              ALL NIPPON AIRWAYS          7
## 104                 SKYWAY AIRLINES         19
## 105              NORTHERN AIR CARGO          4
## 106                     AER LINGUS          6
## 107                   CHAMPION AIR          5
## 108                       SWISSAIR          2
## 109          EPPS AVIATION CHARTER          2
## 110             MOUNTAIN AIR CARGO         11
## 111         BOMBARDIER BUSINESS JET         22
## 112            RAYTHEON TRAVEL AIR          2
## 113                BRITISH AIRWAYS         26
## 114              SUPERIOR AVIATION          7
## 115               POLAR AIR CARGO          4
## 116                      MARTINAIR          2
## 117             TACA INTL AIRLINES          2
## 118                 FLIGHT OPTIONS         78
## 119                       HOP-A-JET          2
## 120                 NORTH AMERICAN         16
## 121            EXPRESS NET AIRLINES          3
## 122                         EVA AIR          5
## 123           SWISS INTL AIR LINES          2
## 124                  CORPORATE AIR          5
## 125            BOSTON-MAINE AIRWAYS          4
## 126             SKYSERVICE AIRLINES          5
## 127                CHICAGO EXPRESS         13
## 128                 MIAMI AIR INTL          4
## 129                AIR NEW ZEALAND          4
## 130     SILVERHAWK AVIATION CHARTER          2
## 131                 CATHAY PACIFIC          5
## 132                       SWIFT AIR          2
## 133                       AIR CHINA          2
## 134                  CHINA AIRLINES          6
## 135           CENTRAL AIR SOUTHWEST          8
## 136                        NETJETS         19
## 137                        USA 3000         22
## 138                      TRANS AIR          7
## 139                          AIR BC          2
## 140      BUSINESS AVIATION COURIER          3
## 141             EXECUTIVE AIRLINES          2
## 142                 AIR CANADA JAZZ         36
## 143             SKYWAY ENTERPRISES          3
## 144                    FLIGHT INTL          2
## 145                ISLAND AIRLINES          5
## 146              INDEPENDENCE AIR         19
## 147                    KALITTA AIR          4
## 148    FLIGHT LINE (AMERICAN CHECK)          3
## 149             CORPORATE AIRLINES          4
## 150         ALASKA CENTRAL EXPRESS          4
## 151                  ALLEGIANT AIR        107
## 152            CAPITAL CARGO INTL          4
## 153                        WESTAIR          5
## 154          CONTINENTAL MICRONESIA          3
## 155                  MIDAMERICAJET          2
## 156                  WORLD AIRWAYS          5
```
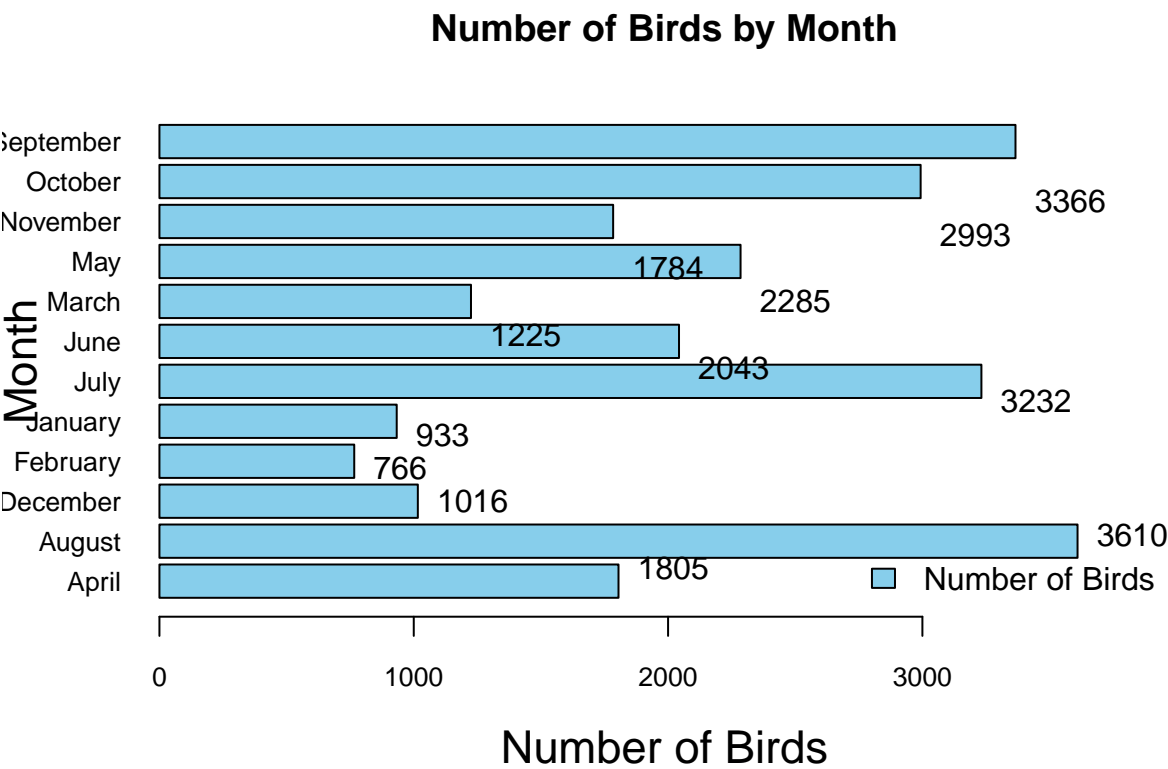
```
## 157         CUSTOM AIR TRANSPORT          2
## 158               ALPINE AIR            2
## 159                 CSA AIR             3
## 160           TRADEWINDS AIRLINES       2
## 161               FLIGHTSTAR            2
## 162            RAM AIR FREIGHT          2
## 163       CARGOLUX AIRLINES INTL        2
## 164            VIRGIN ATLANTIC          6
## 165           REPUBLIC AIRLINES        120
## 166              CITATIONAIR           19
## 167            SCENIC AIRLINES          2
## 168               MARTINAIRE            6
## 169              ACM AVIATION           2
## 170                 QANTAS              5
## 171              PACIFIC WINGS          6
## 172                EMIRATES             4
## 173              SOUTHERN AIR           3
## 174             SKYBUS AIRLINES         8
## 175              ERA AVIATION           5
## 176                 XOJET              17
## 177            COMPASS AIRLINES        32
## 178        BARON AVIATION SERVICES      2
## 179                WESTJET              6
## 180             VIRGIN AMERICA         14
## 181         FRONTIER FLYING SERVICE     3
## 182               AIR FRANCE            2
## 183               PHOENIX AIR           2
## 184            MOKULELE AIRLINES        4
## 185             GOJET AIRLINES         20
## 186        DB AVIATION (NORTHSHORE)     2
## 187          THOMAS COOK AIRLINES       3
## 188              XTRA AIRWAYS           7
## 189              KEY LIME AIR           2
## 190             ALOHA AIR CARGO         9
## 191                JALWAYS              2
## 192               THOMSONFLY            6
## 193              LYNX AVIATION          3
## 194   BOEING COMMERCIAL AIRPLANE GRP   10
## 195            MONARCH AIRLINES         2
## 196                SKY KING             3
## 197              CHANTILLY AIR          3
## 198             VISION AIRLINES         2
## 199             LUFTHANSA CARGO         2
## 200                 AIRPAC              2
## 201            AIR CHINA CARGO          2
## 202                  FAA               2
## 203             PORTER AIRLINES         3
## 204             CANJET AIRLINES         2
## 205             CENTURION CARGO         2
## 206           UFS-UNITED EXPRESS        2
## 207           SINGAPORE AIRLINES        2
## 208                AVANTAIR             4
## 209            ADI SHUTTLE GROUP        8
## 210               AEROMEXICO            2
```

Analysis by Month

```
##          month num_strikes
## 1      January          933
## 2     February          766
## 3        March         1225
## 4        April         1805
## 5          May         2285
## 6         June         2043
## 7         July         3232
## 8       August         3610
## 9    September         3366
## 10     October         2993
## 11    November         1784
## 12    December         1016
```

Trend by Month

Number of Birds by Month

Test the stored procedure by removing a strike

```
## [1] 0

## [1] 0

## [1] 0

## [1] 1

##   id modification_type table_name   modification_time primary_key_str
## 1  1           Removal    strikes 2024-03-13 02:34:42               2
```

```
## 2  2          Removal     strikes 2024-03-13 02:39:18                    2
## [1] TRUE
```