

# Data 602 Project - Zulihumaer Hailaiti, Maciej Pecak, Ewa Rambally

```
library("mosaic")
```

```
## Warning: package 'mosaic' was built under R version 4.3.1
```

```
## Registered S3 method overwritten by 'mosaic':
```

```
##   method                      from  
##   fortify.SpatialPolygonsDataFrame ggplot2
```

```
##
```

```
## The 'mosaic' package masks several functions from core packages in order to add  
## additional features. The original behavior of these functions should not be affected by this.
```

```
##
```

```
## Attaching package: 'mosaic'
```

```
## The following objects are masked from 'package:dplyr':
```

```
##  
##   count, do, tally
```

```
## The following object is masked from 'package:Matrix':
```

```
##  
##   mean
```

```
## The following object is masked from 'package:ggplot2':
```

```
##  
##   stat
```

```
## The following objects are masked from 'package:stats':
```

```
##  
##   binom.test, cor, cor.test, cov, fivenum, IQR, median, prop.test,  
##   quantile, sd, t.test, var
```

```
## The following objects are masked from 'package:base':
```

```
##  
##   max, mean, min, prod, range, sample, sum
```

```
library("ggplot2")
```

```
shelter.df <- read.csv("data/shelter_data.csv")  
head(shelter.df)
```

```
##      Date      City      ShelterType
## 1 4/1/2013 Edmonton Women Emergency
## 2 4/1/2013 Edmonton      Intox
## 3 4/1/2013 Edmonton Adult Emergency
## 4 4/1/2013 Edmonton Winter Emergency
## 5 4/1/2013 Edmonton Youth Emergency
## 6 4/1/2013 Edmonton Women Emergency
##
##              ShelterName Organization
## 1              WEAC              WEAC
## 2              Hope Mission - Intox Centre Hope Mission
## 3              Hope Mission - Herb Jamieson Centre Hope Mission
## 4 Hope Mission - Mat Emergency Shelter Program Hope Mission
## 5              Hope Mission - Youth Hope Mission
## 6              Hope Mission - Women WEmS Hope Mission
##
##              Shelter Capacity Overnight Daytime YEAR MONTH
## 1              75              65      NA 2013      4
## 2              Intox Centre      70              74      NA 2013      4
## 3              Herb Jamieson Centre 250              253      NA 2013      4
## 4 Mat Emergency Shelter Program 200              152      NA 2013      4
## 5              Youth      60              51      NA 2013      4
## 6              Women WEmS      70              51      NA 2013      4
```

```
shelter.df <- shelter.df[(shelter.df$City %in% c("Edmonton", "Calgary")) & shelter.df$YEAR == 2021,]
shelter.df <- shelter.df[!is.na(shelter.df$Capacity), ]
shelter.df <- shelter.df[shelter.df$Capacity > 0, ]
shelter.df$DAY <- format(as.Date(shelter.df$Date, format="%m/%d/%Y"), format = "%d")
head(shelter.df)
```

```
##      Date      City      ShelterType
## 120578 1/1/2021 Edmonton Women Emergency
## 120579 1/1/2021 Edmonton      Intox
## 120581 1/1/2021 Edmonton Winter Emergency
## 120582 1/1/2021 Edmonton Winter Emergency
## 120583 1/1/2021 Edmonton Youth Emergency
## 120584 1/1/2021 Edmonton Women Emergency
##
##              ShelterName Organization
## 120578              WEAC              WEAC
## 120579              Hope Mission - Intox Centre Hope Mission
## 120581 Hope Mission - Herb Jamieson Winter Emergency Hope Mission
## 120582 Hope Mission - Mat Emergency Shelter Program Hope Mission
## 120583              Hope Mission - Youth Hope Mission
## 120584              Hope Mission - Women WEmS Hope Mission
##
##              Shelter Capacity Overnight Daytime YEAR MONTH DAY
## 120578              40              22      NA 2021      1 01
## 120579              Intox Centre      35              39      NA 2021      1 01
## 120581 Herb Jamieson Winter Emergency      60              0      NA 2021      1 01
## 120582 Mat Emergency Shelter Program      85              75      NA 2021      1 01
## 120583              Youth      16              5      NA 2021      1 01
## 120584              Women WEmS      46              48      NA 2021      1 01
```

```
populations <- c(1306780, 1010899)
cities <- c("Calgary", "Edmonton")
population.df <- data.frame(City = cities, population = populations)
```

```
shelter.capacity <- shelter.df %>% group_by(MONTH, DAY, City)
shelter.capacity <- shelter.capacity %>% summarize(summed_by_day_capacity = sum(Capacity))
```

## 'summarise()' has grouped output by 'MONTH', 'DAY'. You can override using the  
## '.groups' argument.

```
shelter.capacity <- shelter.capacity %>% group_by(City)
shelter.capacity <- shelter.capacity %>% summarize(mean_capacity = mean(summed_by_day_capacity))
head(shelter.capacity)
```

```
## # A tibble: 2 x 2
##   City      mean_capacity
##   <chr>         <dbl>
## 1 Calgary      1600.
## 2 Edmonton     1174.
```

```
joined.df <- merge(shelter.capacity, population.df, by.x = "City", by.y = "City", all = FALSE)
joined.df$capacity.per.100k <- joined.df$mean_capacity * 100000 / joined.df$population
head(joined.df)
```

```
##      City mean_capacity population capacity.per.100k
## 1  Calgary      1600.353    1306780      122.4654
## 2  Edmonton     1174.110    1010899      116.1451
```

```
shelter.admissions <- shelter.df %>% group_by(MONTH, DAY, City)
shelter.admissions <- shelter.admissions %>% summarize(summed_by_day_admissions = sum(Overnight))
```

## 'summarise()' has grouped output by 'MONTH', 'DAY'. You can override using the  
## '.groups' argument.

```
shelter.admissions <- merge(shelter.admissions, population.df, by.x = "City", by.y = "City", all = FALSE)
shelter.admissions$daily.admissions.per100k <- shelter.admissions$summed_by_day_admissions * 100000 / shelter.admissions$population
shelter.admissions$Date <- as.Date(paste("2021", shelter.admissions$MONTH, shelter.admissions$DAY, sep = "-"))
```

```
shelter.admissions[(shelter.admissions$City == "Edmonton") & (shelter.admissions$daily.admissions.per100k > 100)]
```

```
##      City MONTH DAY summed_by_day_admissions population
## 638 Edmonton    11  15                976    1010899
## 640 Edmonton    11  16                975    1010899
## 642 Edmonton    11  17                942    1010899
## 644 Edmonton    11  18                940    1010899
## 646 Edmonton    11  19                980    1010899
## 648 Edmonton    11  20                977    1010899
## 650 Edmonton    11  21                976    1010899
## 654 Edmonton    11  23                991    1010899
## 656 Edmonton    11  24                984    1010899
## 658 Edmonton    11  25                942    1010899
## 660 Edmonton    11  26                963    1010899
## 662 Edmonton    11  27                933    1010899
```

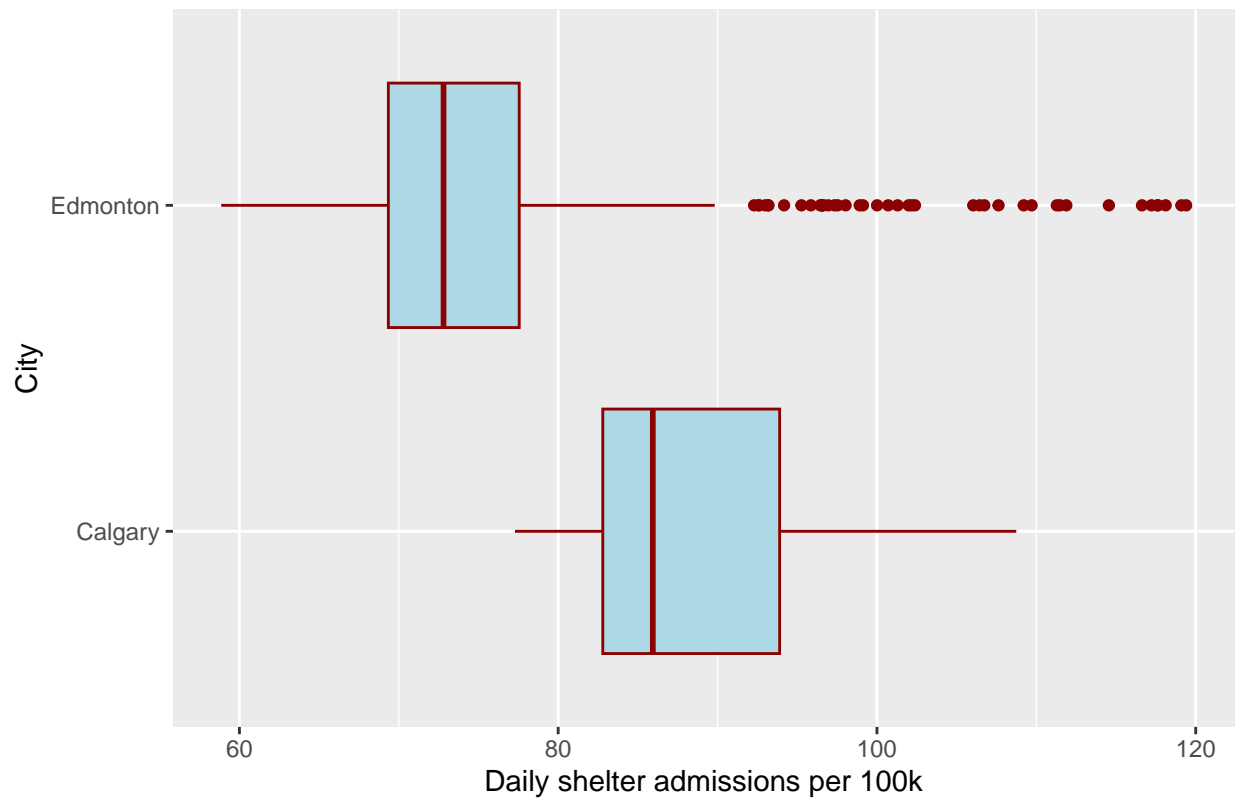
## 664	Edmonton	11	28	936	1010899
## 666	Edmonton	11	29	952	1010899
## 674	Edmonton	12	03	936	1010899
## 676	Edmonton	12	04	1002	1010899
## 678	Edmonton	12	05	1072	1010899
## 680	Edmonton	12	06	1035	1010899
## 682	Edmonton	12	07	969	1010899
## 684	Edmonton	12	08	1018	1010899
## 686	Edmonton	12	09	1033	1010899
## 688	Edmonton	12	10	986	1010899
## 690	Edmonton	12	11	976	1010899
## 692	Edmonton	12	12	1031	1010899
## 694	Edmonton	12	13	1079	1010899
## 696	Edmonton	12	14	1127	1010899
## 698	Edmonton	12	15	1125	1010899
## 700	Edmonton	12	16	1158	1010899
## 702	Edmonton	12	17	1109	1010899
## 704	Edmonton	12	18	1076	1010899
## 706	Edmonton	12	19	1104	1010899
## 708	Edmonton	12	20	1131	1010899
## 710	Edmonton	12	21	1088	1010899
## 712	Edmonton	12	22	1024	1010899
## 714	Edmonton	12	23	1000	1010899
## 716	Edmonton	12	24	1011	1010899
## 718	Edmonton	12	25	1189	1010899
## 720	Edmonton	12	26	1189	1010899
## 722	Edmonton	12	27	1179	1010899
## 724	Edmonton	12	28	1207	1010899
## 726	Edmonton	12	29	1194	1010899
## 728	Edmonton	12	30	1185	1010899
## 730	Edmonton	12	31	1204	1010899
##	daily.admissions.per100k			Date	
## 638		96.54773	2021-11-15		
## 640		96.44880	2021-11-16		
## 642		93.18438	2021-11-17		
## 644		92.98654	2021-11-18		
## 646		96.94341	2021-11-19		
## 648		96.64665	2021-11-20		
## 650		96.54773	2021-11-21		
## 654		98.03155	2021-11-23		
## 656		97.33910	2021-11-24		
## 658		93.18438	2021-11-25		
## 660		95.26174	2021-11-26		
## 662		92.29409	2021-11-27		
## 664		92.59085	2021-11-28		
## 666		94.17360	2021-11-29		
## 674		92.59085	2021-12-03		
## 676		99.11969	2021-12-04		
## 678		106.04422	2021-12-05		
## 680		102.38412	2021-12-06		
## 682		95.85527	2021-12-07		
## 684		100.70244	2021-12-08		
## 686		102.18627	2021-12-09		
## 688		97.53694	2021-12-10		

```
## 690          96.54773 2021-12-11
## 692          101.98843 2021-12-12
## 694          106.73668 2021-12-13
## 696          111.48493 2021-12-14
## 698          111.28708 2021-12-15
## 700          114.55150 2021-12-16
## 702          109.70433 2021-12-17
## 704          106.43991 2021-12-18
## 706          109.20972 2021-12-19
## 708          111.88061 2021-12-20
## 710          107.62697 2021-12-21
## 712          101.29598 2021-12-22
## 714           98.92185 2021-12-23
## 716          100.00999 2021-12-24
## 718          117.61808 2021-12-25
## 720          117.61808 2021-12-26
## 722          116.62886 2021-12-27
## 724          119.39867 2021-12-28
## 726          118.11269 2021-12-29
## 728          117.22239 2021-12-30
## 730          119.10191 2021-12-31
```

```
Calgary.admissions <- shelter.admissions[shelter.admissions$City == "Calgary", "daily.admissions.per100k"]
Edmonton.admissions <- shelter.admissions[shelter.admissions$City == "Edmonton", "daily.admissions.per100k"]
```

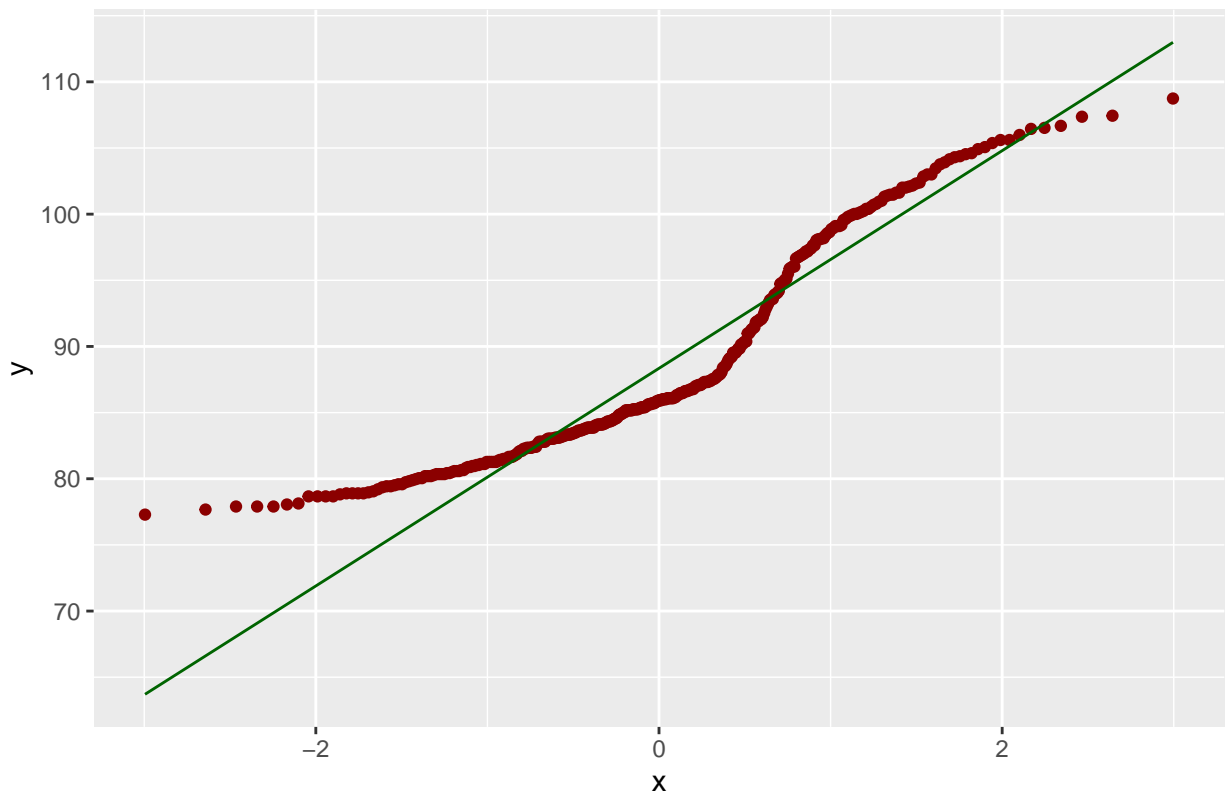
```
ggplot(shelter.admissions, aes(x = City, y = daily.admissions.per100k)) +
  geom_boxplot(col = "darkred", fill = "lightblue") +
  ylab("Daily shelter admissions per 100k") +
  ggtitle("Boxplots of daily shelter admissions in Calgary and Edmonton per 100k") +
  coord_flip()
```

Boxplots of daily shelter admissions in Calgary and Edmonton per 100



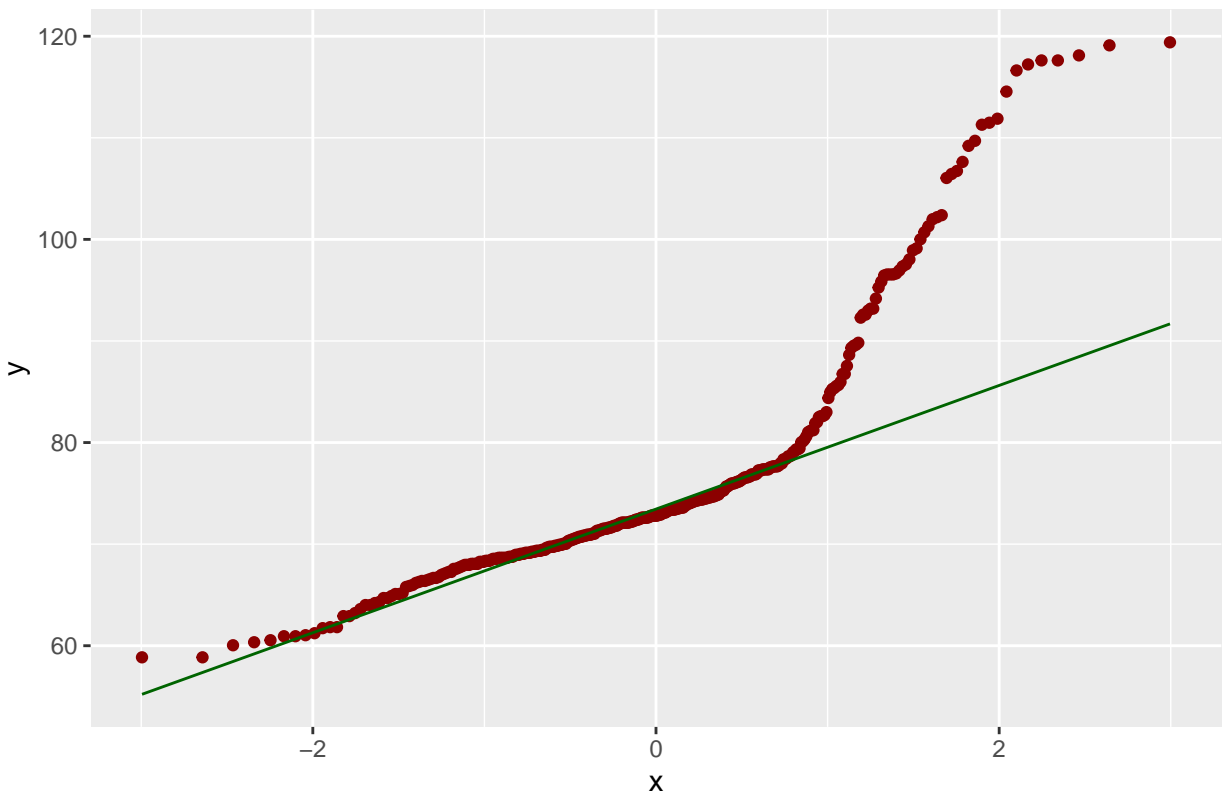
```
ggplot(data.frame(Calgary.admissions), aes(sample = Calgary.admissions)) +
  stat_qq(col = "darkred") +
  stat_qq_line(col = "darkgreen") +
  ggtitle("QQ-plot of daily shelter admissions per 100k in Calgary")
```

QQ-plot of daily shelter admissions per 100k in Calgary



```
ggplot(data.frame(Edmonton.admissions), aes(sample = Edmonton.admissions)) +  
  stat_qq(col = "darkred") +  
  stat_qq_line(col = "darkgreen") +  
  ggtitle("QQ-plot of daily shelter admissions per 100k in Edmonton")
```

QQ-plot of daily shelter admissions per 100k in Edmonton



shelter.admissions

##	City	MONTH	DAY	summed_by_day_admissions	population
## 1	Calgary	1	01	1010	1306780
## 2	Calgary	3	03	1077	1306780
## 3	Calgary	1	02	1015	1306780
## 4	Calgary	3	04	1085	1306780
## 5	Calgary	1	03	1062	1306780
## 6	Calgary	3	05	1075	1306780
## 7	Calgary	1	04	1065	1306780
## 8	Calgary	3	06	1086	1306780
## 9	Calgary	1	05	1059	1306780
## 10	Calgary	3	07	1101	1306780
## 11	Calgary	1	06	1057	1306780
## 12	Calgary	3	08	1106	1306780
## 13	Calgary	1	07	1020	1306780
## 14	Calgary	3	09	1130	1306780
## 15	Calgary	1	08	1040	1306780
## 16	Calgary	3	10	1164	1306780
## 17	Calgary	1	09	1053	1306780
## 18	Calgary	3	11	1129	1306780
## 19	Calgary	1	10	1050	1306780
## 20	Calgary	3	12	1113	1306780
## 21	Calgary	1	11	1054	1306780
## 22	Calgary	3	13	1093	1306780
## 23	Calgary	1	12	1043	1306780



## 24	Calgary	3	14	1076	1306780
## 25	Calgary	1	13	1063	1306780
## 26	Calgary	3	15	1110	1306780
## 27	Calgary	1	14	1050	1306780
## 28	Calgary	3	16	1119	1306780
## 29	Calgary	1	15	1018	1306780
## 30	Calgary	3	17	1088	1306780
## 31	Calgary	1	16	1028	1306780
## 32	Calgary	3	18	1060	1306780
## 33	Calgary	1	17	1065	1306780
## 34	Calgary	3	19	1058	1306780
## 35	Calgary	1	18	1048	1306780
## 36	Calgary	3	20	1062	1306780
## 37	Calgary	1	19	1050	1306780
## 38	Calgary	3	21	1064	1306780
## 39	Calgary	1	20	1067	1306780
## 40	Calgary	3	22	1125	1306780
## 41	Calgary	1	21	1046	1306780
## 42	Calgary	3	23	1094	1306780
## 43	Calgary	1	22	1051	1306780
## 44	Calgary	3	24	1130	1306780
## 45	Calgary	1	23	1088	1306780
## 46	Calgary	3	25	1139	1306780
## 47	Calgary	1	24	1120	1306780
## 48	Calgary	3	26	1125	1306780
## 49	Calgary	1	25	1133	1306780
## 50	Calgary	3	27	1095	1306780
## 51	Calgary	1	26	1093	1306780
## 52	Calgary	3	28	1125	1306780
## 53	Calgary	1	27	1082	1306780
## 54	Calgary	3	29	1132	1306780
## 55	Calgary	1	28	1096	1306780
## 56	Calgary	3	30	1062	1306780
## 57	Calgary	1	29	1082	1306780
## 58	Calgary	3	31	1069	1306780
## 59	Calgary	1	30	1039	1306780
## 60	Calgary	4	01	1030	1306780
## 61	Calgary	1	31	1053	1306780
## 62	Calgary	4	02	1028	1306780
## 63	Calgary	2	01	1028	1306780
## 64	Calgary	4	03	1033	1306780
## 65	Calgary	2	02	1060	1306780
## 66	Calgary	4	04	1075	1306780
## 67	Calgary	2	03	1080	1306780
## 68	Calgary	4	05	1056	1306780
## 69	Calgary	2	04	1042	1306780
## 70	Calgary	4	06	1082	1306780
## 71	Calgary	2	05	1067	1306780
## 72	Calgary	4	07	1062	1306780
## 73	Calgary	2	06	1057	1306780
## 74	Calgary	4	08	1076	1306780
## 75	Calgary	2	07	1105	1306780
## 76	Calgary	4	09	1089	1306780
## 77	Calgary	2	08	1077	1306780

## 78	Calgary	4	10	1095	1306780
## 79	Calgary	2	09	1096	1306780
## 80	Calgary	4	11	1114	1306780
## 81	Calgary	2	10	1124	1306780
## 82	Calgary	4	12	1115	1306780
## 83	Calgary	2	11	1146	1306780
## 84	Calgary	4	13	1117	1306780
## 85	Calgary	2	12	1114	1306780
## 86	Calgary	4	14	1067	1306780
## 87	Calgary	2	13	1122	1306780
## 88	Calgary	4	15	1059	1306780
## 89	Calgary	2	14	1157	1306780
## 90	Calgary	4	16	1049	1306780
## 91	Calgary	2	15	1144	1306780
## 92	Calgary	4	17	1018	1306780
## 93	Calgary	2	16	1096	1306780
## 94	Calgary	4	18	1109	1306780
## 95	Calgary	2	17	1155	1306780
## 96	Calgary	4	19	1109	1306780
## 97	Calgary	2	18	1137	1306780
## 98	Calgary	4	20	1091	1306780
## 99	Calgary	2	19	1132	1306780
## 100	Calgary	4	21	1087	1306780
## 101	Calgary	2	20	1123	1306780
## 102	Calgary	4	22	1124	1306780
## 103	Calgary	2	21	1116	1306780
## 104	Calgary	4	23	1119	1306780
## 105	Calgary	2	22	1141	1306780
## 106	Calgary	4	24	1089	1306780
## 107	Calgary	2	23	1156	1306780
## 108	Calgary	4	25	1123	1306780
## 109	Calgary	2	24	1118	1306780
## 110	Calgary	4	26	1113	1306780
## 111	Calgary	2	25	1113	1306780
## 112	Calgary	4	27	1128	1306780
## 113	Calgary	2	26	1114	1306780
## 114	Calgary	4	28	1098	1306780
## 115	Calgary	2	27	1131	1306780
## 116	Calgary	4	29	1070	1306780
## 117	Calgary	2	28	1126	1306780
## 118	Calgary	4	30	1021	1306780
## 119	Calgary	3	01	1084	1306780
## 120	Calgary	5	01	1038	1306780
## 121	Calgary	3	02	1090	1306780
## 122	Calgary	5	02	1028	1306780
## 123	Calgary	7	02	1086	1306780
## 124	Calgary	5	03	1035	1306780
## 125	Calgary	7	03	1082	1306780
## 126	Calgary	5	04	1031	1306780
## 127	Calgary	7	04	1130	1306780
## 128	Calgary	5	05	1052	1306780
## 129	Calgary	7	05	1122	1306780
## 130	Calgary	5	06	1040	1306780
## 131	Calgary	7	06	1113	1306780

## 132	Calgary	5	07	1048	1306780
## 133	Calgary	7	07	1100	1306780
## 134	Calgary	5	08	1062	1306780
## 135	Calgary	7	08	1103	1306780
## 136	Calgary	5	09	1085	1306780
## 137	Calgary	7	09	1082	1306780
## 138	Calgary	5	10	1091	1306780
## 139	Calgary	7	10	1099	1306780
## 140	Calgary	5	11	1085	1306780
## 141	Calgary	7	11	1111	1306780
## 142	Calgary	5	12	1054	1306780
## 143	Calgary	7	12	1128	1306780
## 144	Calgary	5	13	1065	1306780
## 145	Calgary	7	13	1120	1306780
## 146	Calgary	5	14	1045	1306780
## 147	Calgary	7	14	1116	1306780
## 148	Calgary	5	15	1053	1306780
## 149	Calgary	7	15	1099	1306780
## 150	Calgary	5	16	1048	1306780
## 151	Calgary	7	16	1094	1306780
## 152	Calgary	5	17	1089	1306780
## 153	Calgary	7	17	1102	1306780
## 154	Calgary	5	18	1111	1306780
## 155	Calgary	7	18	1133	1306780
## 156	Calgary	5	19	1121	1306780
## 157	Calgary	7	19	1134	1306780
## 158	Calgary	5	20	1132	1306780
## 159	Calgary	7	20	1123	1306780
## 160	Calgary	5	21	1119	1306780
## 161	Calgary	7	21	1114	1306780
## 162	Calgary	5	22	1099	1306780
## 163	Calgary	7	22	1125	1306780
## 164	Calgary	5	23	1134	1306780
## 165	Calgary	7	23	1073	1306780
## 166	Calgary	5	24	1142	1306780
## 167	Calgary	7	24	1103	1306780
## 168	Calgary	5	25	1125	1306780
## 169	Calgary	7	25	1137	1306780
## 170	Calgary	5	26	1085	1306780
## 171	Calgary	7	26	1120	1306780
## 172	Calgary	5	27	1073	1306780
## 173	Calgary	7	27	1140	1306780
## 174	Calgary	5	28	1050	1306780
## 175	Calgary	7	28	1076	1306780
## 176	Calgary	5	29	1018	1306780
## 177	Calgary	7	29	1125	1306780
## 178	Calgary	5	30	1032	1306780
## 179	Calgary	7	30	1031	1306780
## 180	Calgary	5	31	1031	1306780
## 181	Calgary	7	31	1099	1306780
## 182	Calgary	6	01	1038	1306780
## 183	Calgary	8	01	1138	1306780
## 184	Calgary	6	02	1037	1306780
## 185	Calgary	8	02	1124	1306780

## 186	Calgary	6	03	1044	1306780
## 187	Calgary	8	03	1126	1306780
## 188	Calgary	6	04	1031	1306780
## 189	Calgary	8	04	1134	1306780
## 190	Calgary	6	05	1077	1306780
## 191	Calgary	8	05	1090	1306780
## 192	Calgary	6	06	1114	1306780
## 193	Calgary	8	06	1093	1306780
## 194	Calgary	6	07	1102	1306780
## 195	Calgary	8	07	1142	1306780
## 196	Calgary	6	08	1116	1306780
## 197	Calgary	8	08	1170	1306780
## 198	Calgary	6	09	1100	1306780
## 199	Calgary	8	09	1149	1306780
## 200	Calgary	6	10	1087	1306780
## 201	Calgary	8	10	1138	1306780
## 202	Calgary	6	11	1064	1306780
## 203	Calgary	8	11	1124	1306780
## 204	Calgary	6	12	1051	1306780
## 205	Calgary	8	12	1180	1306780
## 206	Calgary	6	13	1096	1306780
## 207	Calgary	8	13	1089	1306780
## 208	Calgary	6	14	1076	1306780
## 209	Calgary	8	14	1148	1306780
## 210	Calgary	6	15	1108	1306780
## 211	Calgary	8	15	1141	1306780
## 212	Calgary	6	16	1096	1306780
## 213	Calgary	8	16	1209	1306780
## 214	Calgary	6	17	1113	1306780
## 215	Calgary	8	17	1231	1306780
## 216	Calgary	6	18	1085	1306780
## 217	Calgary	8	18	1200	1306780
## 218	Calgary	6	19	1116	1306780
## 219	Calgary	8	19	1145	1306780
## 220	Calgary	6	20	1113	1306780
## 221	Calgary	8	20	1148	1306780
## 222	Calgary	6	21	1072	1306780
## 223	Calgary	8	21	1181	1306780
## 224	Calgary	6	22	1086	1306780
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## 722 Edmonton	12	27	1179	1010899
## 723 Edmonton	10	28	774	1010899
## 724 Edmonton	12	28	1207	1010899
## 725 Edmonton	10	29	819	1010899

## 726	Edmonton	12	29	1194	1010899
## 727	Edmonton	10	30	774	1010899
## 728	Edmonton	12	30	1185	1010899
## 729	Edmonton	10	31	793	1010899
## 730	Edmonton	12	31	1204	1010899
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## 5		81.26846	2021-01-03		
## 6		82.26327	2021-03-05		
## 7		81.49803	2021-01-04		
## 8		83.10504	2021-03-06		
## 9		81.03889	2021-01-05		
## 10		84.25290	2021-03-07		
## 11		80.88584	2021-01-06		
## 12		84.63552	2021-03-08		
## 13		78.05445	2021-01-07		
## 14		86.47209	2021-03-09		
## 15		79.58493	2021-01-08		
## 16		89.07391	2021-03-10		
## 17		80.57975	2021-01-09		
## 18		86.39557	2021-03-11		
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## 20		85.17118	2021-03-12		
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## 23		79.81451	2021-01-12		
## 24		82.33980	2021-03-14		
## 25		81.34499	2021-01-13		
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## 27		80.35017	2021-01-14		
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## 33		81.49803	2021-01-17		
## 34		80.96237	2021-03-19		
## 35		80.19713	2021-01-18		
## 36		81.26846	2021-03-20		
## 37		80.35017	2021-01-19		
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## 39		81.65108	2021-01-20		
## 40		86.08947	2021-03-22		
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## 42		83.71723	2021-03-23		
## 43		80.42670	2021-01-22		
## 44		86.47209	2021-03-24		
## 45		83.25808	2021-01-23		
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## 53	82.79894	2021-01-27
## 54	86.62514	2021-03-29
## 55	83.87028	2021-01-28
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## 57	82.79894	2021-01-29
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## 75	84.55899	2021-02-07
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## 81	86.01295	2021-02-10
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## 490	68.75069	2021-05-04
## 491	68.25608	2021-07-04
## 492	68.84961	2021-05-05
## 493	67.16794	2021-07-05
## 494	66.47548	2021-05-06
## 495	68.65176	2021-07-06
## 496	71.61942	2021-05-07
## 497	68.05823	2021-07-07
## 498	75.18061	2021-05-08
## 499	64.00244	2021-07-08
## 500	74.19139	2021-05-09
## 501	67.95931	2021-07-09
## 502	72.21295	2021-05-10
## 503	67.56362	2021-07-10
## 504	73.40001	2021-05-11
## 505	70.72912	2021-07-11
## 506	66.97009	2021-05-12
## 507	68.65176	2021-07-12
## 508	68.25608	2021-05-13
## 509	68.75069	2021-07-13
## 510	65.88195	2021-05-14
## 511	68.55284	2021-07-14
## 512	66.77225	2021-05-15
## 513	70.82805	2021-07-15
## 514	67.95931	2021-05-16
## 515	72.31187	2021-07-16
## 516	72.80648	2021-05-17
## 517	77.35689	2021-07-17
## 518	84.38034	2021-05-18
## 519	77.25797	2021-07-18
## 520	81.21484	2021-05-19
## 521	72.60864	2021-07-19
## 522	78.64287	2021-05-20
## 523	72.80648	2021-07-20
## 524	74.29031	2021-05-21
## 525	78.74179	2021-07-21
## 526	75.47737	2021-05-22
## 527	76.07090	2021-07-22
## 528	69.24530	2021-05-23
## 529	73.99354	2021-07-23
## 530	75.67522	2021-05-24
## 531	70.92697	2021-07-24
## 532	77.95042	2021-05-25
## 533	77.25797	2021-07-25
## 534	74.09247	2021-05-26

## 535	74.19139	2021-07-26
## 536	75.97198	2021-05-27
## 537	72.50972	2021-07-27
## 538	72.11403	2021-05-28
## 539	70.72912	2021-07-28
## 540	71.22373	2021-05-29
## 541	67.26686	2021-07-29
## 542	69.64098	2021-05-30
## 543	62.91430	2021-07-30
## 544	66.67333	2021-05-31
## 545	64.00244	2021-07-31
## 546	60.34233	2021-06-01
## 547	64.69489	2021-08-01
## 548	60.04556	2021-06-02
## 549	67.66255	2021-08-02
## 550	60.93586	2021-06-03
## 551	69.24530	2021-08-03
## 552	67.76147	2021-06-04
## 553	70.72912	2021-08-04
## 554	71.32265	2021-06-05
## 555	66.27764	2021-08-05
## 556	70.53128	2021-06-06
## 557	68.35500	2021-08-06
## 558	74.38923	2021-06-07
## 559	74.38923	2021-08-07
## 560	76.07090	2021-06-08
## 561	72.60864	2021-08-08
## 562	76.16983	2021-06-09
## 563	70.53128	2021-08-09
## 564	76.66443	2021-06-10
## 565	70.43236	2021-08-10
## 566	72.11403	2021-06-11
## 567	72.90540	2021-08-11
## 568	73.20217	2021-06-12
## 569	69.44314	2021-08-12
## 570	69.34422	2021-06-13
## 571	68.25608	2021-08-13
## 572	74.88384	2021-06-14
## 573	70.92697	2021-08-14
## 574	74.68600	2021-06-15
## 575	71.42158	2021-08-15
## 576	74.58708	2021-06-16
## 577	74.68600	2021-08-16
## 578	76.86228	2021-06-17
## 579	73.49894	2021-08-17
## 580	72.41079	2021-06-18
## 581	72.60864	2021-08-18
## 582	66.57441	2021-06-19
## 583	71.02589	2021-08-19
## 584	69.64098	2021-06-20
## 585	70.33344	2021-08-20
## 586	69.14637	2021-06-21
## 587	72.11403	2021-08-21
## 588	71.52050	2021-06-22



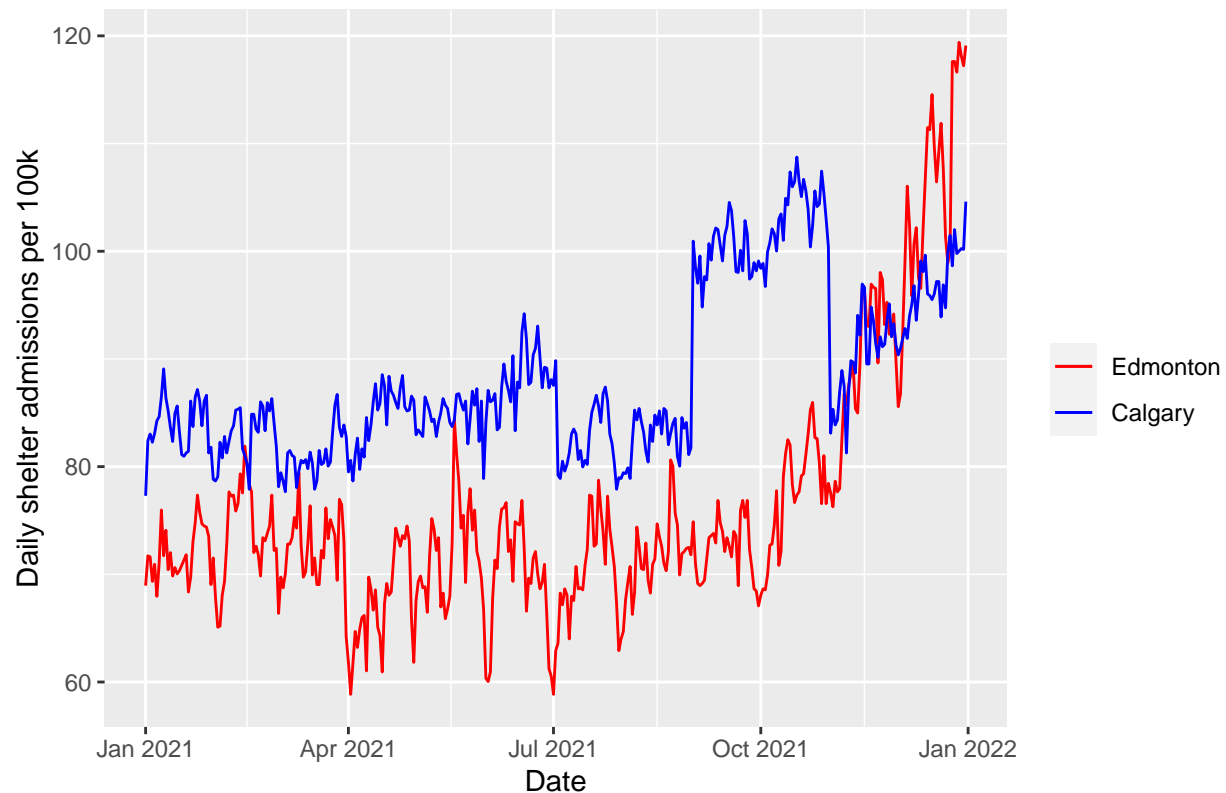
## 589	80.62131	2021-08-22
## 590	72.11403	2021-06-23
## 591	80.02778	2021-08-23
## 592	70.03667	2021-06-24
## 593	75.67522	2021-08-24
## 594	68.65176	2021-06-25
## 595	74.58708	2021-08-25
## 596	69.24530	2021-06-26
## 597	69.93775	2021-08-26
## 598	70.92697	2021-06-27
## 599	71.91619	2021-08-27
## 600	66.37656	2021-06-28
## 601	72.11403	2021-08-28
## 602	61.23263	2021-06-29
## 603	72.41079	2021-08-29
## 604	60.54017	2021-06-30
## 605	72.50972	2021-08-30
## 606	58.85850	2021-07-01
## 607	71.81726	2021-08-31
## 608	62.91430	2021-07-02
## 609	74.88384	2021-09-01
## 610	77.55473	2021-11-01
## 611	71.02589	2021-09-02
## 612	76.26875	2021-11-02
## 613	69.14637	2021-09-03
## 614	78.64287	2021-11-03
## 615	68.94853	2021-09-04
## 616	77.65365	2021-11-04
## 617	69.14637	2021-09-05
## 618	77.95042	2021-11-05
## 619	69.44314	2021-09-06
## 620	82.59975	2021-11-06
## 621	71.42158	2021-09-07
## 622	86.75446	2021-11-07
## 623	73.40001	2021-09-08
## 624	85.66632	2021-11-08
## 625	73.59786	2021-09-09
## 626	87.54584	2021-11-09
## 627	73.79570	2021-09-10
## 628	88.63398	2021-11-10
## 629	72.90540	2021-09-11
## 630	89.32643	2021-11-11
## 631	76.86228	2021-09-12
## 632	85.36956	2021-11-12
## 633	74.78492	2021-09-13
## 634	84.97387	2021-11-13
## 635	73.99354	2021-09-14
## 636	89.52427	2021-11-14
## 637	72.11403	2021-09-15
## 638	96.54773	2021-11-15
## 639	73.40001	2021-09-16
## 640	96.44880	2021-11-16
## 641	72.60864	2021-09-17
## 642	93.18438	2021-11-17

## 643	71.61942	2021-09-18
## 644	92.98654	2021-11-18
## 645	73.99354	2021-09-19
## 646	96.94341	2021-11-19
## 647	73.59786	2021-09-20
## 648	96.64665	2021-11-20
## 649	68.94853	2021-09-21
## 650	96.54773	2021-11-21
## 651	75.97198	2021-09-22
## 652	89.62320	2021-11-22
## 653	76.86228	2021-09-23
## 654	98.03155	2021-11-23
## 655	75.27953	2021-09-24
## 656	97.33910	2021-11-24
## 657	76.86228	2021-09-25
## 658	93.18438	2021-11-25
## 659	72.31187	2021-09-26
## 660	95.26174	2021-11-26
## 661	70.63020	2021-09-27
## 662	92.29409	2021-11-27
## 663	68.65176	2021-09-28
## 664	92.59085	2021-11-28
## 665	68.45392	2021-09-29
## 666	94.17360	2021-11-29
## 667	67.06901	2021-09-30
## 668	89.82104	2021-11-30
## 669	68.05823	2021-10-01
## 670	85.56740	2021-12-01
## 671	68.65176	2021-10-02
## 672	86.75446	2021-12-02
## 673	68.55284	2021-10-03
## 674	92.59085	2021-12-03
## 675	69.93775	2021-10-04
## 676	99.11969	2021-12-04
## 677	72.70756	2021-10-05
## 678	106.04422	2021-12-05
## 679	72.80648	2021-10-06
## 680	102.38412	2021-12-06
## 681	74.58708	2021-10-07
## 682	95.85527	2021-12-07
## 683	77.75257	2021-10-08
## 684	100.70244	2021-12-08
## 685	70.82805	2021-10-09
## 686	102.18627	2021-12-09
## 687	72.11403	2021-10-10
## 688	97.53694	2021-12-10
## 689	79.03856	2021-10-11
## 690	96.54773	2021-12-11
## 691	81.21484	2021-10-12
## 692	101.98843	2021-12-12
## 693	82.50082	2021-10-13
## 694	106.73668	2021-12-13
## 695	82.00621	2021-10-14
## 696	111.48493	2021-12-14

```
## 697          78.34611 2021-10-15
## 698          111.28708 2021-12-15
## 699          76.66443 2021-10-16
## 700          114.55150 2021-12-16
## 701          77.35689 2021-10-17
## 702          109.70433 2021-12-17
## 703          77.65365 2021-10-18
## 704          106.43991 2021-12-18
## 705          79.13748 2021-10-19
## 706          109.20972 2021-12-19
## 707          79.33532 2021-10-20
## 708          111.88061 2021-12-20
## 709          81.11592 2021-10-21
## 710          107.62697 2021-12-21
## 711          82.99543 2021-10-22
## 712          101.29598 2021-12-22
## 713          85.27064 2021-10-23
## 714          98.92185 2021-12-23
## 715          85.96309 2021-10-24
## 716          100.00999 2021-12-24
## 717          82.69867 2021-10-25
## 718          117.61808 2021-12-25
## 719          82.59975 2021-10-26
## 720          117.61808 2021-12-26
## 721          80.32454 2021-10-27
## 722          116.62886 2021-12-27
## 723          76.56551 2021-10-28
## 724          119.39867 2021-12-28
## 725          81.01700 2021-10-29
## 726          118.11269 2021-12-29
## 727          76.56551 2021-10-30
## 728          117.22239 2021-12-30
## 729          78.44503 2021-10-31
## 730          119.10191 2021-12-31
```

```
timeseries.df <- data.frame(
  Date = shelter.admissions[shelter.admissions$City == "Edmonton", "Date"],
  Edmonton = shelter.admissions[shelter.admissions$City == "Edmonton", "daily.admissions.per100k"],
  Calgary = shelter.admissions[shelter.admissions$City == "Calgary", "daily.admissions.per100k"]
)
ggplot(timeseries.df, aes(x = Date)) +
  geom_line(aes(y = Edmonton, colour = "Edmonton")) +
  geom_line(aes(y = Calgary, colour = "Calgary")) +
  scale_colour_manual("",
    breaks = c("Edmonton", "Calgary"),
    values = c("red", "blue")) +
  xlab("Date") +
  ylab("Daily shelter admissions per 100k") +
  ggtitle("Timeseries graph Edmonton and Calgary daily shelter admissions")
```

Timeseries graph Edmonton and Calgary daily shelter admissions



$$H_0 : \mu_{\text{Calgary}} = (\leq) \mu_{\text{Edmonton}} \quad H_1 : \mu_{\text{Calgary}} > \mu_{\text{Edmonton}}$$

```
Calgary.sample <- sample(Calgary.admissions, 50, replace = FALSE)
Edmonton.sample <- sample(Edmonton.admissions, 50, replace = FALSE)

t.test(Calgary.sample, Edmonton.sample, conf.level = .95, var.equal = FALSE, paired = FALSE, alternative = "greater")

##
##  Welch Two Sample t-test
##
## data:  Calgary.sample and Edmonton.sample
## t = 6.6071, df = 93.133, p-value = 1.202e-09
## alternative hypothesis: true difference in means is greater than 0
## 95 percent confidence interval:
##  9.437306      Inf
## sample estimates:
## mean of x mean of y
##  88.91780  76.31029
```

## WEATHER AND OCCUPANCY

```
shelter.df <- read.csv("data/shelter_data.csv")
shelter.df <- shelter.df[shelter.df$City == "Calgary",]
shelter.df <- shelter.df[
  ((shelter.df$YEAR == 2018) & (shelter.df$MONTH %in% c(10, 11, 12))) |
  ((shelter.df$YEAR == 2019) & (shelter.df$MONTH %in% c( 1,  2,  3))),
  c("YEAR", "MONTH", "Overnight", "Capacity", "Date")
]
shelter.df <- shelter.df[!is.na(shelter.df$Capacity), ]
shelter.df <- shelter.df[shelter.df$Capacity > 0, ]
shelter.df$Date <- as.Date(shelter.df$Date, format = "%m/%d/%Y")
shelter.df$DAY <- format(as.Date(shelter.df$Date, format="%m/%d/%Y"), format = "%d")
shelter.df$DAY <- as.integer(shelter.df$DAY)
```

```
shelter.admissions <- shelter.df %>% group_by(YEAR, MONTH, DAY)
shelter.admissions <- shelter.admissions %>% summarize(summed_by_day_admissions = sum(Overnight), summed_by_day_capacity = sum(Capacity))
```

## 'summarise()' has grouped output by 'YEAR', 'MONTH'. You can override using the  
## '.groups' argument.

```
shelter.admissions$Occupancy.Rate <- shelter.admissions$summed_by_day_admissions / shelter.admissions$summed_by_day_capacity
```

```
shelter.admissions
```

```
## # A tibble: 181 x 6
## # Groups:   YEAR, MONTH [6]
##   YEAR MONTH   DAY summed_by_day_admissions summed_by_day_capacity
##   <int> <int> <int>                <int>                <int>
## 1  2018    10     1                1780                2363
## 2  2018    10     2                1814                2363
## 3  2018    10     3                1785                2363
## 4  2018    10     4                1781                2363
## 5  2018    10     5                1694                2363
## 6  2018    10     6                1698                2363
## 7  2018    10     7                1743                2363
## 8  2018    10     8                1806                2363
## 9  2018    10     9                1827                2363
## 10 2018    10    10                1816                2363
## # i 171 more rows
## # i 1 more variable: Occupancy.Rate <dbl>
```

```
calgary.weather.df <- read.csv("data/weather_data_calgary.csv")
calgary.weather.df <- calgary.weather.df[
  (calgary.weather.df["Date"] >= "2018-10-01") &
  (calgary.weather.df["Date"] < "2019-04-01") &
  (calgary.weather.df["Township"] == "T023R01W5"),
  c("Date", "Air.Temp..Min....C.")
]
names(calgary.weather.df) <- c("Date", "Min.Temp.C")
```

```

calgary.weather.df$DAY <- format(as.Date(calgary.weather.df$Date, format="%Y-%m-%d"), format = "%d")
calgary.weather.df$DAY <- as.integer(calgary.weather.df$DAY)

calgary.weather.df$MONTH <- format(as.Date(calgary.weather.df$Date, format="%Y-%m-%d"), format = "%m")
calgary.weather.df$MONTH <- as.integer(calgary.weather.df$MONTH)

calgary.weather.df$YEAR <- format(as.Date(calgary.weather.df$Date, format="%Y-%m-%d"), format = "%Y")
calgary.weather.df$YEAR <- as.integer(calgary.weather.df$YEAR)

joined.df <- merge(shelter.admissions, calgary.weather.df, by = c("YEAR", "MONTH", "DAY"), all = FALSE)
joined.df$Date <- as.Date(joined.df$Date, format = "%Y-%m-%d")
joined.df

```

##	YEAR	MONTH	DAY	summed_by_day_admissions	summed_by_day_capacity
## 1	2018	10	1	1780	2363
## 2	2018	10	10	1816	2363
## 3	2018	10	11	1790	2363
## 4	2018	10	12	1748	2363
## 5	2018	10	13	1715	2363
## 6	2018	10	14	1790	2363
## 7	2018	10	15	1723	2363
## 8	2018	10	16	1729	2363
## 9	2018	10	17	1685	2363
## 10	2018	10	18	1735	2363
## 11	2018	10	19	1676	2363
## 12	2018	10	2	1814	2363
## 13	2018	10	20	1654	2363
## 14	2018	10	21	1743	2363
## 15	2018	10	22	1734	2363
## 16	2018	10	23	1734	2363
## 17	2018	10	24	1734	2363
## 18	2018	10	25	1704	2363
## 19	2018	10	26	1607	2363
## 20	2018	10	27	1612	2363
## 21	2018	10	28	1653	2363
## 22	2018	10	29	1685	2363
## 23	2018	10	3	1785	2363
## 24	2018	10	30	1716	2363
## 25	2018	10	31	1721	2363
## 26	2018	10	4	1781	2363
## 27	2018	10	5	1694	2363
## 28	2018	10	6	1698	2363
## 29	2018	10	7	1743	2363
## 30	2018	10	8	1806	2363
## 31	2018	10	9	1827	2363
## 32	2018	11	1	1738	2363
## 33	2018	11	10	1782	2363
## 34	2018	11	11	1805	2363
## 35	2018	11	12	1801	2363
## 36	2018	11	13	1778	2363
## 37	2018	11	14	1800	2363
## 38	2018	11	15	1770	2363
## 39	2018	11	16	1813	2363

## 40	2018	11	17	1750	2363
## 41	2018	11	18	1834	2363
## 42	2018	11	19	1844	2363
## 43	2018	11	2	1703	2363
## 44	2018	11	20	1807	2363
## 45	2018	11	21	1820	2363
## 46	2018	11	22	1807	2363
## 47	2018	11	23	1820	2363
## 48	2018	11	24	1784	2363
## 49	2018	11	25	1845	2363
## 50	2018	11	26	1826	2363
## 51	2018	11	27	1690	2363
## 52	2018	11	28	1604	2363
## 53	2018	11	29	1701	2363
## 54	2018	11	3	1632	2363
## 55	2018	11	30	1699	2363
## 56	2018	11	4	1726	2363
## 57	2018	11	5	1762	2363
## 58	2018	11	6	1817	2363
## 59	2018	11	7	1814	2363
## 60	2018	11	8	1825	2363
## 61	2018	11	9	1788	2363
## 62	2018	12	1	1770	2361
## 63	2018	12	10	1822	2361
## 64	2018	12	11	1821	2361
## 65	2018	12	12	1809	2361
## 66	2018	12	13	1703	2361
## 67	2018	12	14	1695	2361
## 68	2018	12	15	1722	2361
## 69	2018	12	16	1803	2361
## 70	2018	12	17	1789	2361
## 71	2018	12	18	1686	2361
## 72	2018	12	19	1627	2361
## 73	2018	12	2	1797	2361
## 74	2018	12	20	1521	2361
## 75	2018	12	21	1592	2361
## 76	2018	12	22	1560	2361
## 77	2018	12	23	1635	2361
## 78	2018	12	24	1625	2361
## 79	2018	12	25	1605	2361
## 80	2018	12	26	1664	2361
## 81	2018	12	27	1715	2361
## 82	2018	12	28	1681	2361
## 83	2018	12	29	1682	2361
## 84	2018	12	3	1830	2361
## 85	2018	12	30	1700	2361
## 86	2018	12	31	1685	2361
## 87	2018	12	4	1838	2361
## 88	2018	12	5	1863	2361
## 89	2018	12	6	1847	2361
## 90	2018	12	8	1779	2361
## 91	2018	12	9	1800	2361
## 92	2019	1	1	1722	2286
## 93	2019	1	10	1831	2286

## 94	2019	1	11	1730	2286
## 95	2019	1	12	1743	2286
## 96	2019	1	13	1817	2286
## 97	2019	1	14	1815	2286
## 98	2019	1	15	1828	2286
## 99	2019	1	16	1841	2286
## 100	2019	1	17	1844	2286
## 101	2019	1	18	1854	2286
## 102	2019	1	19	1778	2286
## 103	2019	1	2	1724	2286
## 104	2019	1	20	1826	2286
## 105	2019	1	21	1812	2286
## 106	2019	1	22	1828	2286
## 107	2019	1	23	1908	2286
## 108	2019	1	24	1866	2286
## 109	2019	1	25	1784	2286
## 110	2019	1	26	1684	2286
## 111	2019	1	27	1807	2286
## 112	2019	1	28	1770	2286
## 113	2019	1	29	1721	2286
## 114	2019	1	3	1725	2286
## 115	2019	1	30	1719	2286
## 116	2019	1	31	1740	2286
## 117	2019	1	4	1731	2286
## 118	2019	1	5	1790	2286
## 119	2019	1	6	1795	2286
## 120	2019	1	7	1833	2286
## 121	2019	1	8	1851	2286
## 122	2019	1	9	1840	2286
## 123	2019	2	1	1730	2286
## 124	2019	2	10	1813	2286
## 125	2019	2	11	1842	2286
## 126	2019	2	12	1840	2286
## 127	2019	2	13	1854	2286
## 128	2019	2	14	1832	2286
## 129	2019	2	15	1818	2286
## 130	2019	2	16	1797	2286
## 131	2019	2	17	1837	2286
## 132	2019	2	18	1828	2286
## 133	2019	2	19	1828	2286
## 134	2019	2	2	1774	2286
## 135	2019	2	20	1817	2286
## 136	2019	2	21	1819	2286
## 137	2019	2	22	1777	2286
## 138	2019	2	23	1717	2286
## 139	2019	2	24	1731	2286
## 140	2019	2	25	1737	2286
## 141	2019	2	26	1712	2286
## 142	2019	2	27	1721	2286
## 143	2019	2	28	1705	2286
## 144	2019	2	3	1827	2286
## 145	2019	2	4	1840	2286
## 146	2019	2	5	1854	2286
## 147	2019	2	6	1849	2286



## 148 2019	2	7	1795	2286
## 149 2019	2	8	1824	2286
## 150 2019	2	9	1770	2286
## 151 2019	3	1	1709	2361
## 152 2019	3	10	1779	2361
## 153 2019	3	11	1760	2361
## 154 2019	3	12	1790	2361
## 155 2019	3	13	1774	2361
## 156 2019	3	14	1769	2361
## 157 2019	3	15	1683	2361
## 158 2019	3	16	1655	2361
## 159 2019	3	17	1723	2361
## 160 2019	3	18	1713	2361
## 161 2019	3	19	1664	2361
## 162 2019	3	2	1700	2361
## 163 2019	3	20	1653	2361
## 164 2019	3	21	1661	2361
## 165 2019	3	22	1574	2361
## 166 2019	3	23	1621	2361
## 167 2019	3	24	1605	2361
## 168 2019	3	25	1662	2361
## 169 2019	3	26	1586	2361
## 170 2019	3	27	1604	2361
## 171 2019	3	28	1543	2361
## 172 2019	3	29	1499	2361
## 173 2019	3	3	1802	2361
## 174 2019	3	30	1469	2361
## 175 2019	3	31	1666	2361
## 176 2019	3	4	1788	2361
## 177 2019	3	5	1752	2361
## 178 2019	3	6	1771	2361
## 179 2019	3	7	1757	2361
## 180 2019	3	8	1726	2361
## 181 2019	3	9	1711	2361
##	Occupancy.Rate	Date	Min.Temp.C	
## 1	0.7532797	2018-10-01	-2.79	
## 2	0.7685146	2018-10-10	-4.86	
## 3	0.7575116	2018-10-11	-2.49	
## 4	0.7397376	2018-10-12	-1.42	
## 5	0.7257723	2018-10-13	-3.62	
## 6	0.7575116	2018-10-14	-6.52	
## 7	0.7291579	2018-10-15	3.27	
## 8	0.7316970	2018-10-16	0.84	
## 9	0.7130766	2018-10-17	2.26	
## 10	0.7342361	2018-10-18	3.52	
## 11	0.7092679	2018-10-19	-1.23	
## 12	0.7676682	2018-10-02	-4.58	
## 13	0.6999577	2018-10-20	0.24	
## 14	0.7376217	2018-10-21	-2.05	
## 15	0.7338129	2018-10-22	-3.77	
## 16	0.7338129	2018-10-23	-2.24	
## 17	0.7338129	2018-10-24	2.47	
## 18	0.7211172	2018-10-25	0.05	
## 19	0.6800677	2018-10-26	-1.08	

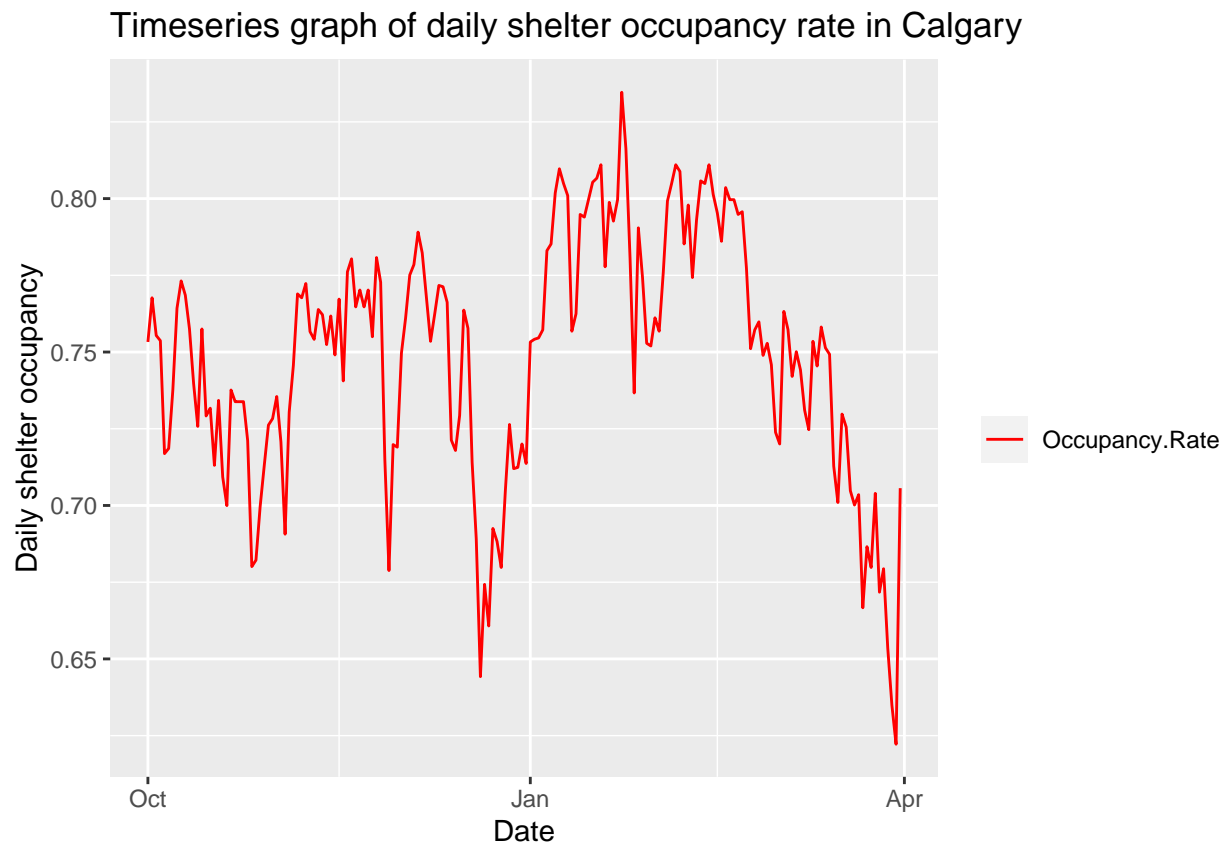
## 20	0.6821837	2018-10-27	-0.73
## 21	0.6995345	2018-10-28	-1.01
## 22	0.7130766	2018-10-29	-1.18
## 23	0.7553957	2018-10-03	-10.18
## 24	0.7261955	2018-10-30	-1.64
## 25	0.7283115	2018-10-31	-0.80
## 26	0.7537029	2018-10-04	-6.09
## 27	0.7168853	2018-10-05	-6.26
## 28	0.7185781	2018-10-06	-4.69
## 29	0.7376217	2018-10-07	-4.09
## 30	0.7642827	2018-10-08	-3.53
## 31	0.7731697	2018-10-09	-5.09
## 32	0.7355057	2018-11-01	0.26
## 33	0.7541261	2018-11-10	-3.57
## 34	0.7638595	2018-11-11	-8.64
## 35	0.7621667	2018-11-12	-10.81
## 36	0.7524333	2018-11-13	-1.58
## 37	0.7617435	2018-11-14	-0.21
## 38	0.7490478	2018-11-15	-1.65
## 39	0.7672450	2018-11-16	-15.30
## 40	0.7405840	2018-11-17	-16.37
## 41	0.7761320	2018-11-18	-4.77
## 42	0.7803639	2018-11-19	-3.28
## 43	0.7206940	2018-11-02	-1.11
## 44	0.7647059	2018-11-20	-0.99
## 45	0.7702074	2018-11-21	-1.55
## 46	0.7647059	2018-11-22	-2.25
## 47	0.7702074	2018-11-23	-5.17
## 48	0.7549725	2018-11-24	-10.10
## 49	0.7807871	2018-11-25	-8.43
## 50	0.7727465	2018-11-26	-7.73
## 51	0.7151926	2018-11-27	1.49
## 52	0.6787981	2018-11-28	-2.41
## 53	0.7198477	2018-11-29	-6.84
## 54	0.6906475	2018-11-03	-3.17
## 55	0.7190013	2018-11-30	-8.69
## 56	0.7304274	2018-11-04	-2.82
## 57	0.7456623	2018-11-05	-8.41
## 58	0.7689378	2018-11-06	-10.77
## 59	0.7676682	2018-11-07	-13.45
## 60	0.7723233	2018-11-08	-13.70
## 61	0.7566653	2018-11-09	-11.99
## 62	0.7496823	2018-12-01	-5.66
## 63	0.7717069	2018-12-10	-1.15
## 64	0.7712834	2018-12-11	-7.43
## 65	0.7662008	2018-12-12	-4.27
## 66	0.7213045	2018-12-13	-3.95
## 67	0.7179161	2018-12-14	-2.75
## 68	0.7293520	2018-12-15	-7.17
## 69	0.7636595	2018-12-16	-8.19
## 70	0.7577298	2018-12-17	-4.00
## 71	0.7141042	2018-12-18	-3.20
## 72	0.6891148	2018-12-19	-2.54
## 73	0.7611182	2018-12-02	-6.10

## 74	0.6442186	2018-12-20	-3.26
## 75	0.6742906	2018-12-21	-4.24
## 76	0.6607370	2018-12-22	-10.21
## 77	0.6925032	2018-12-23	-7.68
## 78	0.6882677	2018-12-24	-11.92
## 79	0.6797967	2018-12-25	-10.31
## 80	0.7047861	2018-12-26	-8.91
## 81	0.7263871	2018-12-27	-10.26
## 82	0.7119864	2018-12-28	-12.95
## 83	0.7124100	2018-12-29	-4.31
## 84	0.7750953	2018-12-03	-9.97
## 85	0.7200339	2018-12-30	-13.55
## 86	0.7136806	2018-12-31	-16.53
## 87	0.7784837	2018-12-04	-11.53
## 88	0.7890724	2018-12-05	-15.39
## 89	0.7822956	2018-12-06	-18.39
## 90	0.7534943	2018-12-08	-10.87
## 91	0.7623888	2018-12-09	-7.26
## 92	0.7532808	2019-01-01	-11.95
## 93	0.8009624	2019-01-10	-11.28
## 94	0.7567804	2019-01-11	-8.68
## 95	0.7624672	2019-01-12	-3.30
## 96	0.7948381	2019-01-13	-5.50
## 97	0.7939633	2019-01-14	-7.62
## 98	0.7996500	2019-01-15	-9.48
## 99	0.8053368	2019-01-16	-8.76
## 100	0.8066492	2019-01-17	-16.70
## 101	0.8110236	2019-01-18	-17.99
## 102	0.7777778	2019-01-19	-18.64
## 103	0.7541557	2019-01-02	3.99
## 104	0.7987752	2019-01-20	-8.74
## 105	0.7926509	2019-01-21	-9.63
## 106	0.7996500	2019-01-22	-10.33
## 107	0.8346457	2019-01-23	-17.92
## 108	0.8162730	2019-01-24	-19.28
## 109	0.7804024	2019-01-25	-7.96
## 110	0.7366579	2019-01-26	-3.89
## 111	0.7904637	2019-01-27	-6.20
## 112	0.7742782	2019-01-28	-11.62
## 113	0.7528434	2019-01-29	-15.36
## 114	0.7545932	2019-01-03	-0.63
## 115	0.7519685	2019-01-30	-9.17
## 116	0.7611549	2019-01-31	-4.79
## 117	0.7572178	2019-01-04	-5.23
## 118	0.7830271	2019-01-05	-9.63
## 119	0.7852143	2019-01-06	-7.85
## 120	0.8018373	2019-01-07	-13.27
## 121	0.8097113	2019-01-08	-16.09
## 122	0.8048994	2019-01-09	-12.18
## 123	0.7567804	2019-02-01	-16.57
## 124	0.7930884	2019-02-10	-30.86
## 125	0.8057743	2019-02-11	-27.95
## 126	0.8048994	2019-02-12	-28.80
## 127	0.8110236	2019-02-13	-25.11

## 128	0.8013998	2019-02-14	-23.58
## 129	0.7952756	2019-02-15	-22.52
## 130	0.7860892	2019-02-16	-18.00
## 131	0.8035871	2019-02-17	-20.03
## 132	0.7996500	2019-02-18	-25.00
## 133	0.7996500	2019-02-19	-18.87
## 134	0.7760280	2019-02-02	-22.66
## 135	0.7948381	2019-02-20	-13.61
## 136	0.7957130	2019-02-21	-20.36
## 137	0.7773403	2019-02-22	-16.06
## 138	0.7510936	2019-02-23	-20.08
## 139	0.7572178	2019-02-24	-25.49
## 140	0.7598425	2019-02-25	-28.44
## 141	0.7489064	2019-02-26	-25.47
## 142	0.7528434	2019-02-27	-21.75
## 143	0.7458443	2019-02-28	-13.23
## 144	0.7992126	2019-02-03	-28.24
## 145	0.8048994	2019-02-04	-28.80
## 146	0.8110236	2019-02-05	-30.39
## 147	0.8088364	2019-02-06	-27.39
## 148	0.7852143	2019-02-07	-25.80
## 149	0.7979003	2019-02-08	-24.63
## 150	0.7742782	2019-02-09	-29.13
## 151	0.7238458	2019-03-01	-27.87
## 152	0.7534943	2019-03-10	-14.99
## 153	0.7454468	2019-03-11	-3.99
## 154	0.7581533	2019-03-12	-3.14
## 155	0.7513765	2019-03-13	-7.29
## 156	0.7492588	2019-03-14	-10.72
## 157	0.7128335	2019-03-15	-5.28
## 158	0.7009742	2019-03-16	-8.11
## 159	0.7297755	2019-03-17	-6.12
## 160	0.7255400	2019-03-18	-2.27
## 161	0.7047861	2019-03-19	-1.61
## 162	0.7200339	2019-03-02	-32.32
## 163	0.7001271	2019-03-20	-0.92
## 164	0.7035155	2019-03-21	-1.03
## 165	0.6666667	2019-03-22	-1.98
## 166	0.6865735	2019-03-23	-1.62
## 167	0.6797967	2019-03-24	-1.37
## 168	0.7039390	2019-03-25	-2.07
## 169	0.6717493	2019-03-26	-0.51
## 170	0.6793731	2019-03-27	-2.06
## 171	0.6535366	2019-03-28	-3.89
## 172	0.6349005	2019-03-29	-2.85
## 173	0.7632359	2019-03-03	-28.50
## 174	0.6221940	2019-03-30	-2.48
## 175	0.7056332	2019-03-31	-0.29
## 176	0.7573062	2019-03-04	-24.44
## 177	0.7420584	2019-03-05	-19.51
## 178	0.7501059	2019-03-06	-23.30
## 179	0.7441762	2019-03-07	-18.14
## 180	0.7310462	2019-03-08	-12.94
## 181	0.7246929	2019-03-09	-13.34

```
ggplot(joined.df, aes(x = Date)) +
  geom_line(aes(y = Occupancy.Rate, colour = "Occupancy.Rate")) +
  scale_colour_manual("",
                     breaks = c("Occupancy.Rate"),
                     values = c("red")) +

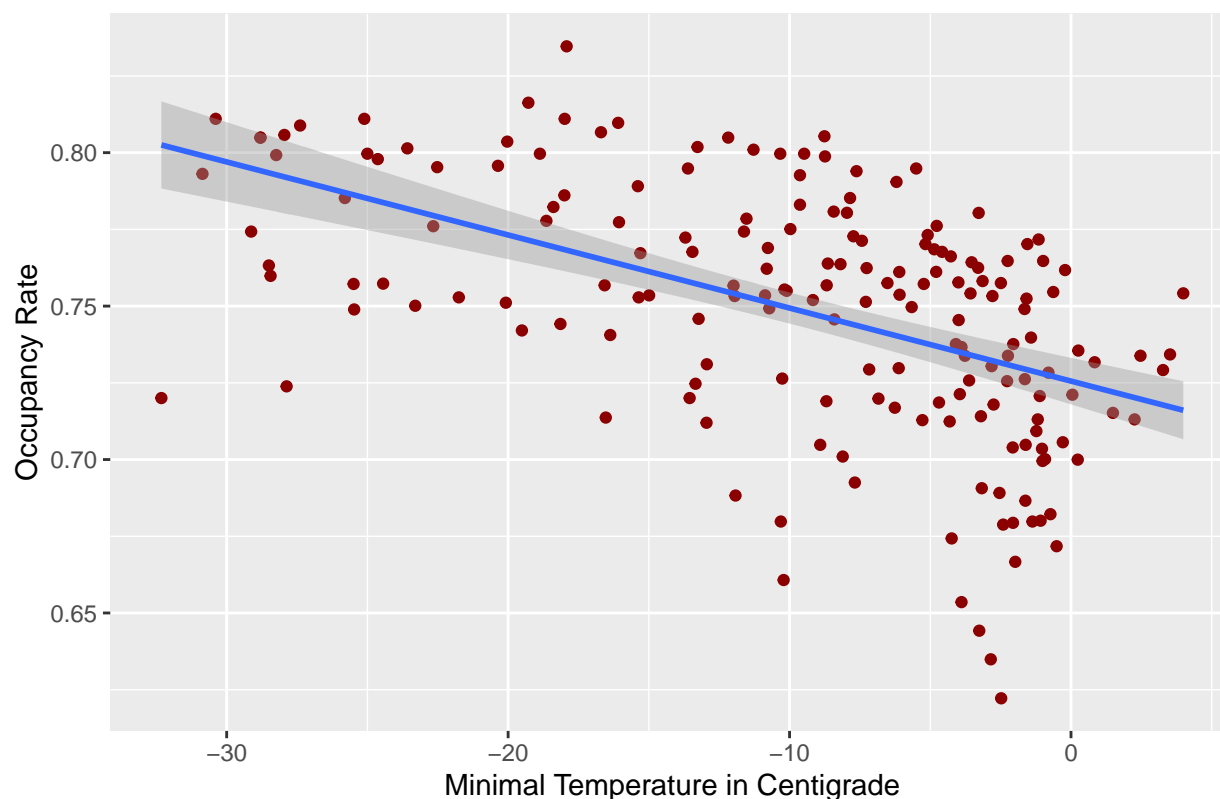
  xlab("Date") +
  ylab("Daily shelter occupancy") +
  ggtitle("Timeseries graph of daily shelter occupancy rate in Calgary")
```



```
ggplot(joined.df, aes(x = Min.Temp.C, y = Occupancy.Rate)) +
  geom_point(col = "darkred") +
  xlab("Minimal Temperature in Centigrade") +
  ylab("Occupancy Rate") +
  geom_smooth(method = "lm") +
  ggtitle("Relationship between Air Temperature and shelters occupancy in Calgary")
```

```
## 'geom_smooth()' using formula = 'y ~ x'
```

## Relationship between Air Temperature and shelters occupancy in Calgary



```
occupancy.weather.model <- lm(Occupancy.Rate ~ Min.Temp.C, data = joined.df)
summary(occupancy.weather.model)
```

```
##
## Call:
## lm(formula = Occupancy.Rate ~ Min.Temp.C, data = joined.df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.10927 -0.02395  0.00642  0.02548  0.06642
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.7255582  0.0038430 188.802  < 2e-16 ***
## Min.Temp.C   -0.0023808  0.0002965  -8.029 1.27e-13 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.03451 on 179 degrees of freedom
## Multiple R-squared:  0.2648, Adjusted R-squared:  0.2607
## F-statistic: 64.46 on 1 and 179 DF, p-value: 1.266e-13
```

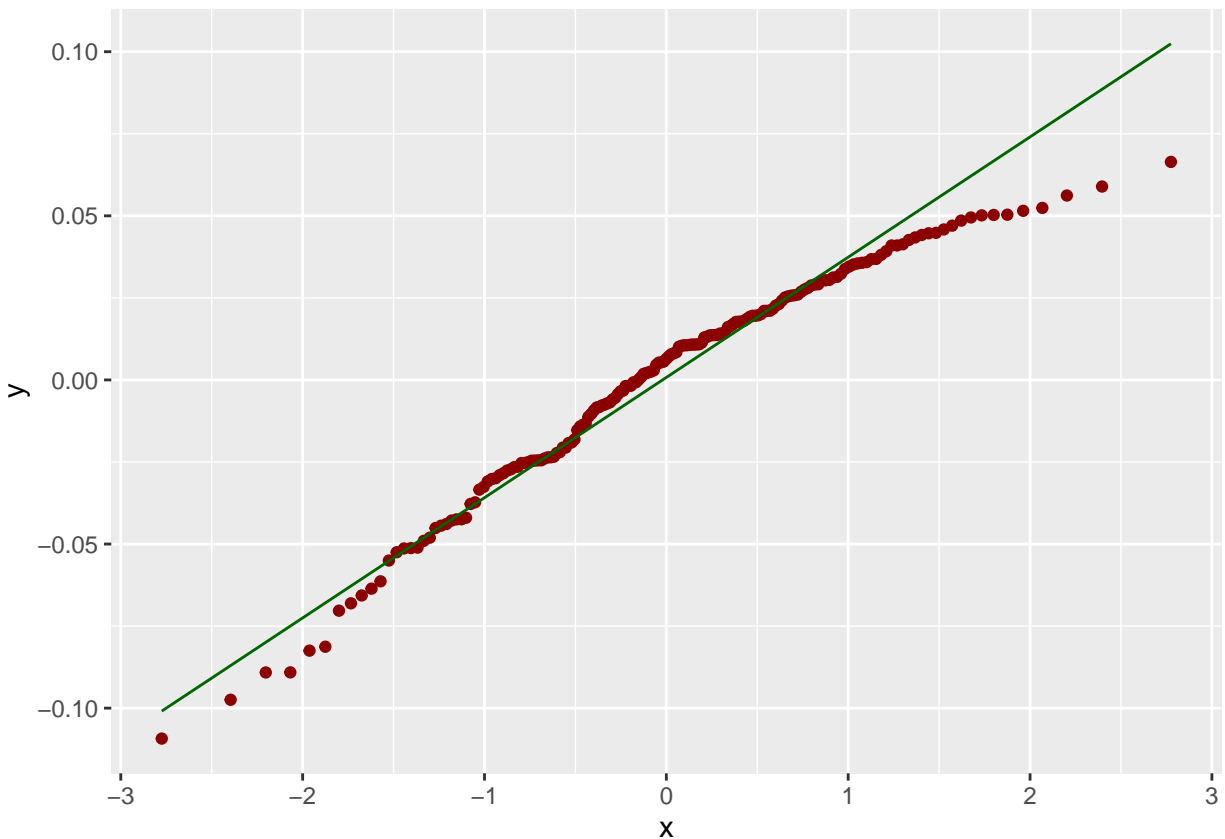
```
aov(occupancy.weather.model)
```

```
## Call:
```

```
## aov(formula = occupancy.weather.model)
##
## Terms:
##             Min.Temp.C Residuals
## Sum of Squares  0.0767534 0.2131447
## Deg. of Freedom      1      179
##
## Residual standard error: 0.03450729
## Estimated effects may be unbalanced
```

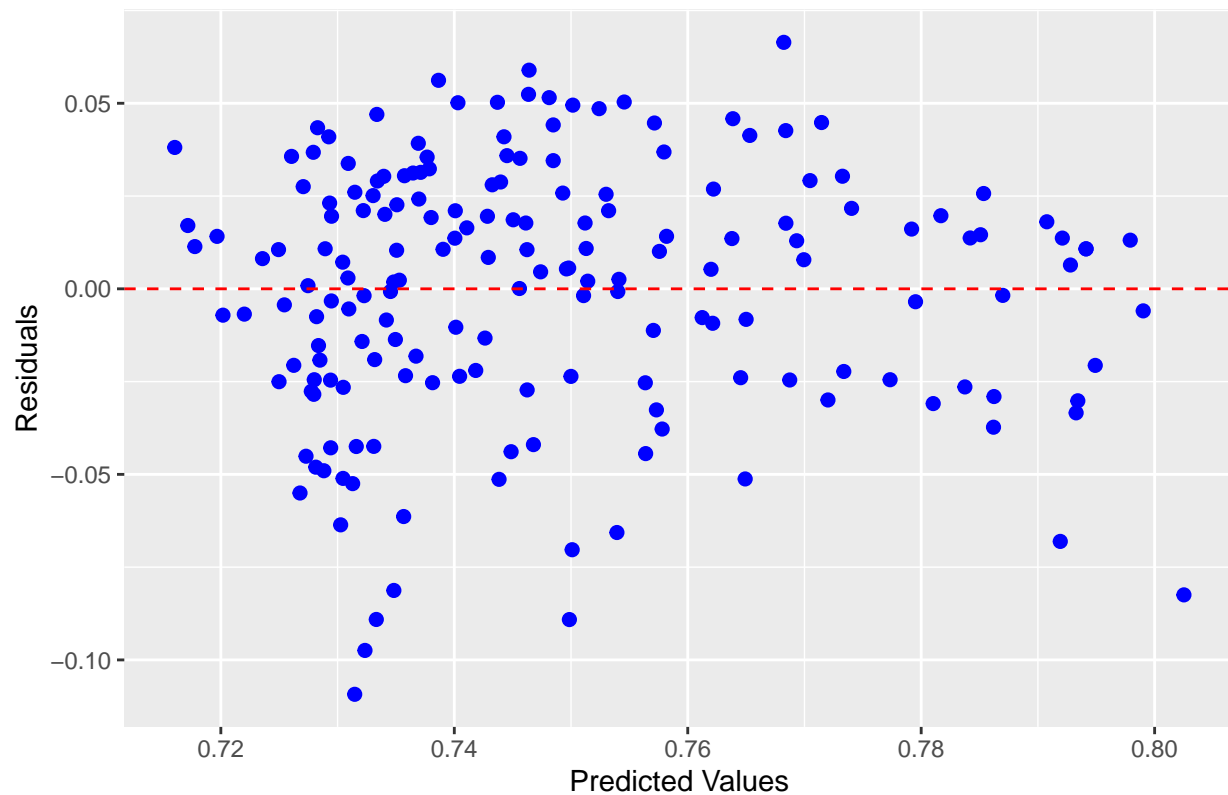
```
diagnostics.df <- data.frame(
  residuals = occupancy.weather.model$residuals,
  pred.values = occupancy.weather.model$fitted.values
)
```

```
ggplot(diagnostics.df, aes(sample = residuals)) +
  stat_qq(col = "darkred") +
  stat_qq_line(col = "darkgreen")
```



```
ggplot(diagnostics.df, aes(x = pred.values, y = residuals)) +
  geom_point(col = "blue", size = 2, position = "jitter") +
  geom_hline(yintercept = 0, color = "red", linetype = "dashed") +
  xlab("Predicted Values") +
  ylab("Residuals") +
  ggtitle("Fit of residuals for the regression")
```

Fit of residuals for the regression



```
confint(occupancy.weather.model, conf.level=0.95)
```

```
##                2.5 %      97.5 %
## (Intercept)  0.717974865  0.733141504
## Min.Temp.C  -0.002966001 -0.001795655
```

```
predict(occupancy.weather.model, newdata=data.frame(Min.Temp.C = -5), interval="predict")
```

```
##      fit      lwr      upr
## 1 0.7374623 0.6691269 0.8057978
```

```
predict(occupancy.weather.model, newdata=data.frame(Min.Temp.C = -5), interval="conf")
```

```
##      fit      lwr      upr
## 1 0.7374623 0.7317158 0.7432088
```