Cosmic Expedition Analytics

Presented By

SAKSHAM KHETARPAL

Problem Statements:-

1) What are the average temperature details of the launch sites?

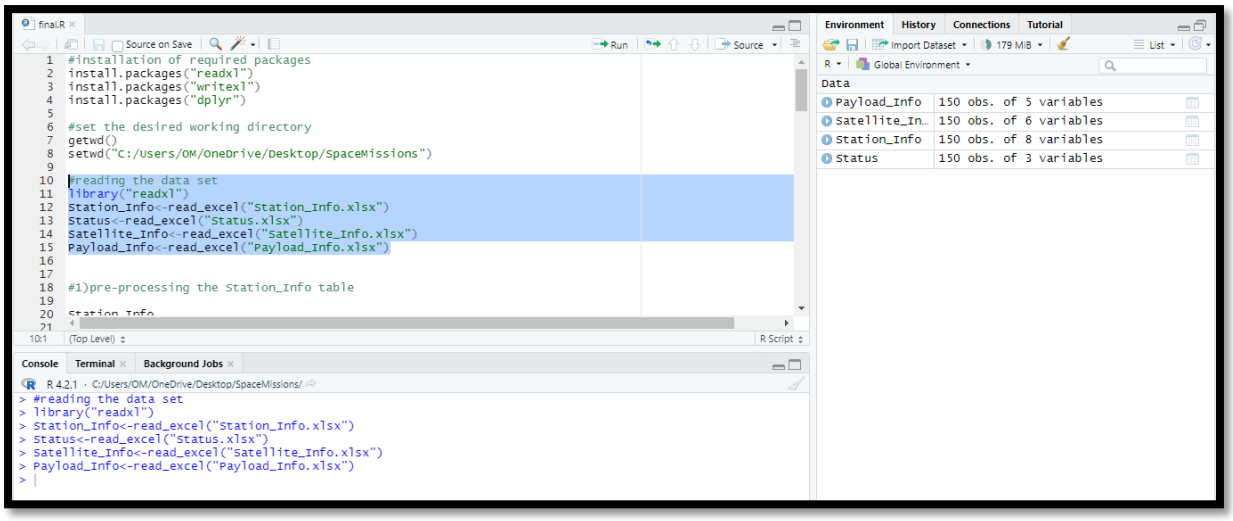
2) What are the average Wind Speeds details of the launch sites?

3) What are the average Humidity details of the launch sites?

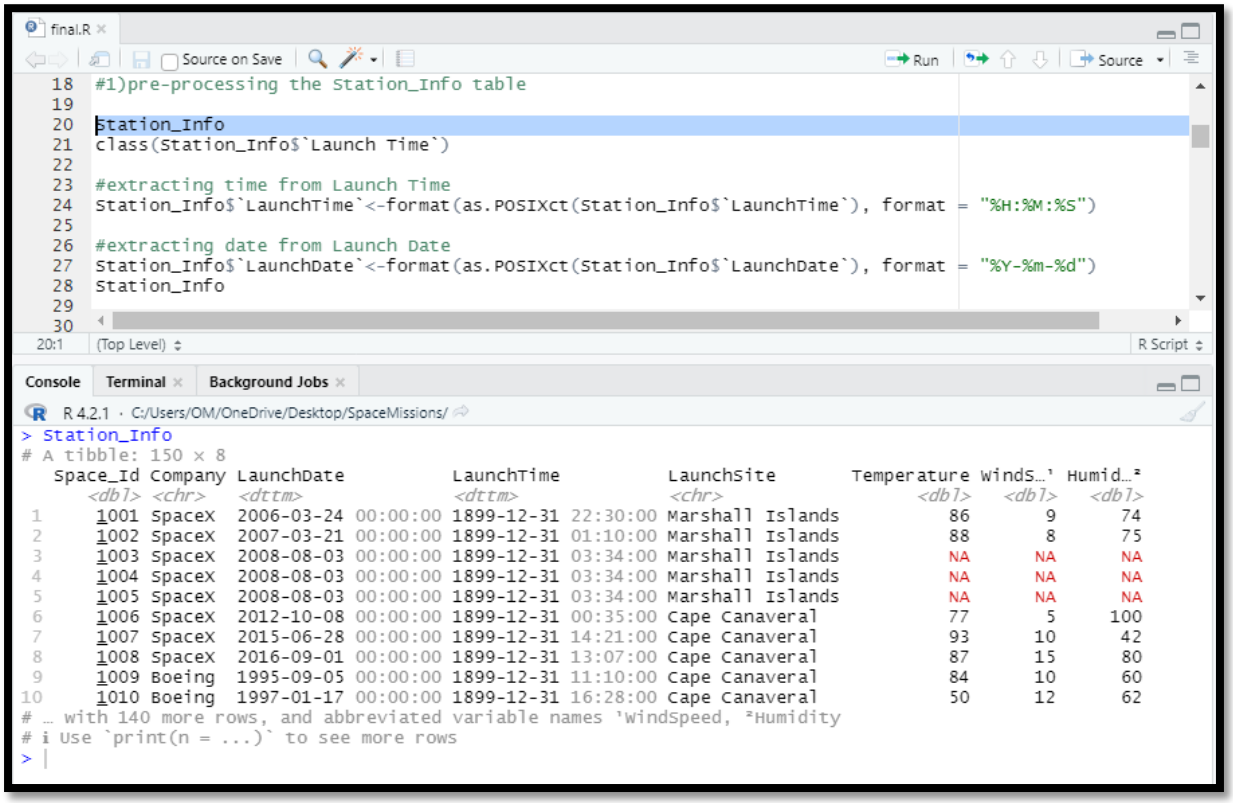
4) What are the different varieties of launch vehicles used by different companies?

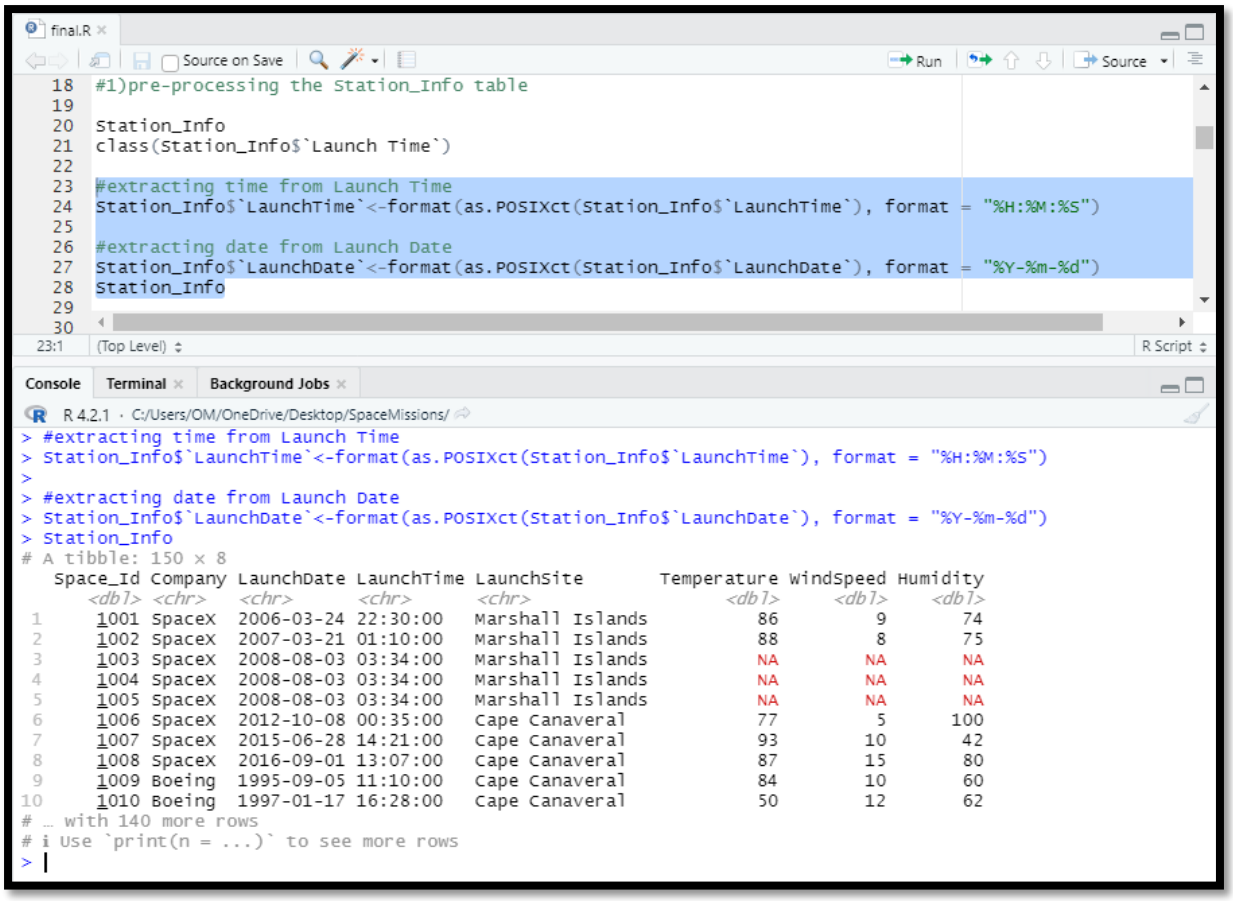
5) What is the Mission Status of the companies?

6) Track Records of the Launch Sites.



Station_Info:





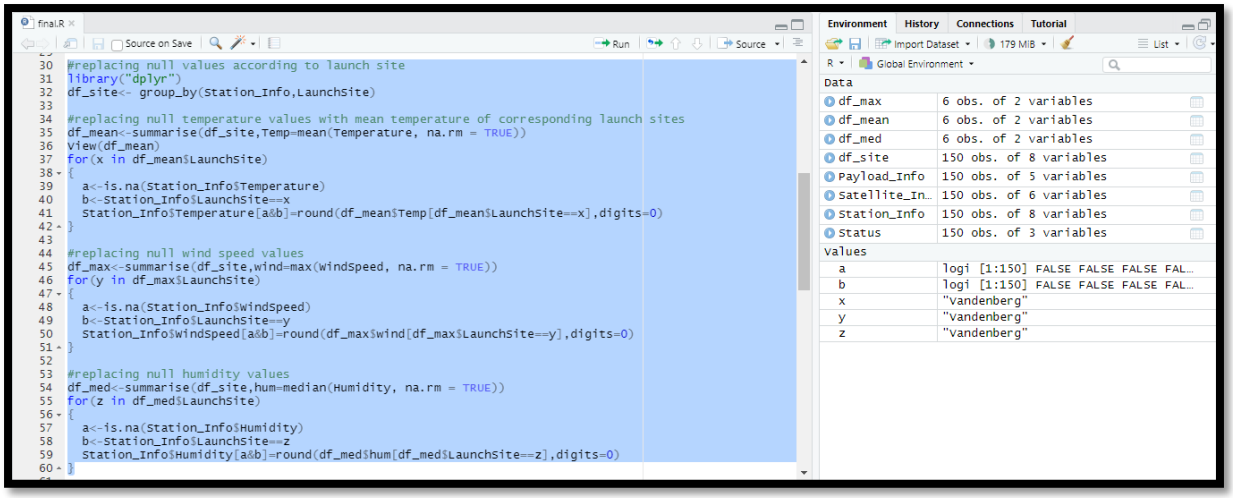
```
#1)pre-processing the Station_Info table

Station_Info
class(Station_Info$`Launch Time`)

#extracting time from Launch Time
Station_Info$`LaunchTime`<-format(as.POSIXct(Station_Info$`LaunchTime`), format = "%H:%M:%S")

#extracting date from Launch Date
Station_Info$`LaunchDate`<-format(as.POSIXct(Station_Info$`LaunchDate`), format = "%Y-%m-%d")
Station_Info
```

```
> #extracting time from Launch Time
> Station_Info$`LaunchTime`<-format(as.POSIXct(Station_Info$`LaunchTime`), format = "%H:%M:%S")
>
> #extracting date from Launch Date
> Station_Info$`LaunchDate`<-format(as.POSIXct(Station_Info$`LaunchDate`), format = "%Y-%m-%d")
> Station_Info
# A tibble: 150 × 8
   Space_Id Company LaunchDate LaunchTime LaunchSite       Temperature WindSpeed Humidity
      <dbl> <chr>   <chr>      <chr>      <chr>                  <dbl>     <dbl>    <dbl>
 1     1001 SpaceX  2006-03-24 22:30:00   Marshall Islands          86         9       74
 2     1002 SpaceX  2007-03-21 01:10:00   Marshall Islands          88         8       75
 3     1003 SpaceX  2008-08-03 03:34:00   Marshall Islands          NA        NA       NA
 4     1004 SpaceX  2008-08-03 03:34:00   Marshall Islands          NA        NA       NA
 5     1005 SpaceX  2008-08-03 03:34:00   Marshall Islands          NA        NA       NA
 6     1006 SpaceX  2012-10-08 00:35:00   Cape Canaveral            77         5      100
 7     1007 SpaceX  2015-06-28 14:21:00   Cape Canaveral            93        10       42
 8     1008 SpaceX  2016-09-01 13:07:00   Cape Canaveral            87        15       80
 9     1009 Boeing  1995-09-05 11:10:00   Cape Canaveral            84        10       60
10     1010 Boeing  1997-01-17 16:28:00   Cape Canaveral            50        12       62
# … with 140 more rows
# ℹ Use `print(n = ...)` to see more rows
>
```



```
#replacing null values according to launch site
library("dplyr")
df_site<- group_by(Station_Info,LaunchSite)

#replacing null temperature values with mean temperature of corresponding launch sites
df_mean<-summarise(df_site,Temp=mean(Temperature, na.rm = TRUE))
View(df_mean)
for(x in df_mean$LaunchSite)
{
  a<-is.na(Station_Info$Temperature)
  b<-Station_Info$LaunchSite==x
  Station_Info$Temperature[a&b]=round(df_mean$Temp[df_mean$LaunchSite==x],digits=0)
}

#replacing null wind speed values
df_max<-summarise(df_site,wind=max(WindSpeed, na.rm = TRUE))
for(y in df_max$LaunchSite)
{
  a<-is.na(Station_Info$WindSpeed)
  b<-Station_Info$LaunchSite==y
  Station_Info$WindSpeed[a&b]=round(df_max$wind[df_max$LaunchSite==y],digits=0)
}

#replacing null humidity values
df_med<-summarise(df_site,hum=median(Humidity, na.rm = TRUE))
for(z in df_med$LaunchSite)
{
  a<-is.na(Station_Info$Humidity)
  b<-Station_Info$LaunchSite==z
  Station_Info$Humidity[a&b]=round(df_med$hum[df_med$LaunchSite==z],digits=0)
}
```

Data	
df_max	6 obs. of 2 variables
df_mean	6 obs. of 2 variables
df_med	6 obs. of 2 variables
df_site	150 obs. of 8 variables
Payload_Info	150 obs. of 5 variables
Satellite_In…	150 obs. of 6 variables
Station_Info	150 obs. of 8 variables
Status	150 obs. of 3 variables
Values	
a	logi [1:150] FALSE FALSE FALSE FAL…
b	logi [1:150] FALSE FALSE FALSE FAL…
x	"vandenberg"
y	"vandenberg"
z	"vandenberg"

final.R × Station_Info ×

Filter

	Space_Id	Company	LaunchDate	LaunchTime	LaunchSite	Temperature	WindSpeed	Humidity
1	1001	SpaceX	2006-03-24	22:30:00	Marshall Islands	86	9	74
2	1002	SpaceX	2007-03-21	01:10:00	Marshall Islands	88	8	75
3	1003	SpaceX	2008-08-03	03:34:00	Marshall Islands	87	9	74
4	1004	SpaceX	2008-08-03	03:34:00	Marshall Islands	87	9	74
5	1005	SpaceX	2008-08-03	03:34:00	Marshall Islands	87	9	74
6	1006	SpaceX	2012-10-08	00:35:00	Cape Canaveral	77	5	100
7	1007	SpaceX	2015-06-28	14:21:00	Cape Canaveral	93	10	42
8	1008	SpaceX	2016-09-01	13:07:00	Cape Canaveral	87	15	80
9	1009	Boeing	1995-09-05	11:10:00	Cape Canaveral	84	10	60
10	1010	Boeing	1997-01-17	16:28:00	Cape Canaveral	50	12	62
11	1011	Boeing	1998-08-27	01:17:00	Cape Canaveral	82	7	89
12	1012	Boeing	1999-05-05	01:00:00	Cape Canaveral	70	8	64
13	1013	Boeing	2004-12-21	21:50:00	Cape Canaveral	62	5	83
14	1014	Martin Marietta	1993-10-05	17:56:00	Vandenberg	62	12	89
15	1015	US Air Force	1996-08-26	13:59:00	Cape Canaveral	90	12	70
16	1016	US Air Force	1973-06-26	14:45:00	Vandenberg	50	10	80
17	1017	US Air Force	1972-05-20	15:30:00	Vandenberg	64	20	46
18	1018	US Air Force	1967-06-20	16:19:00	Vandenberg	60	15	80
19	1019	US Air Force	1967-04-26	15:25:00	Vandenberg	56	12	75

Showing 1 to 20 of 150 entries, 8 total columns

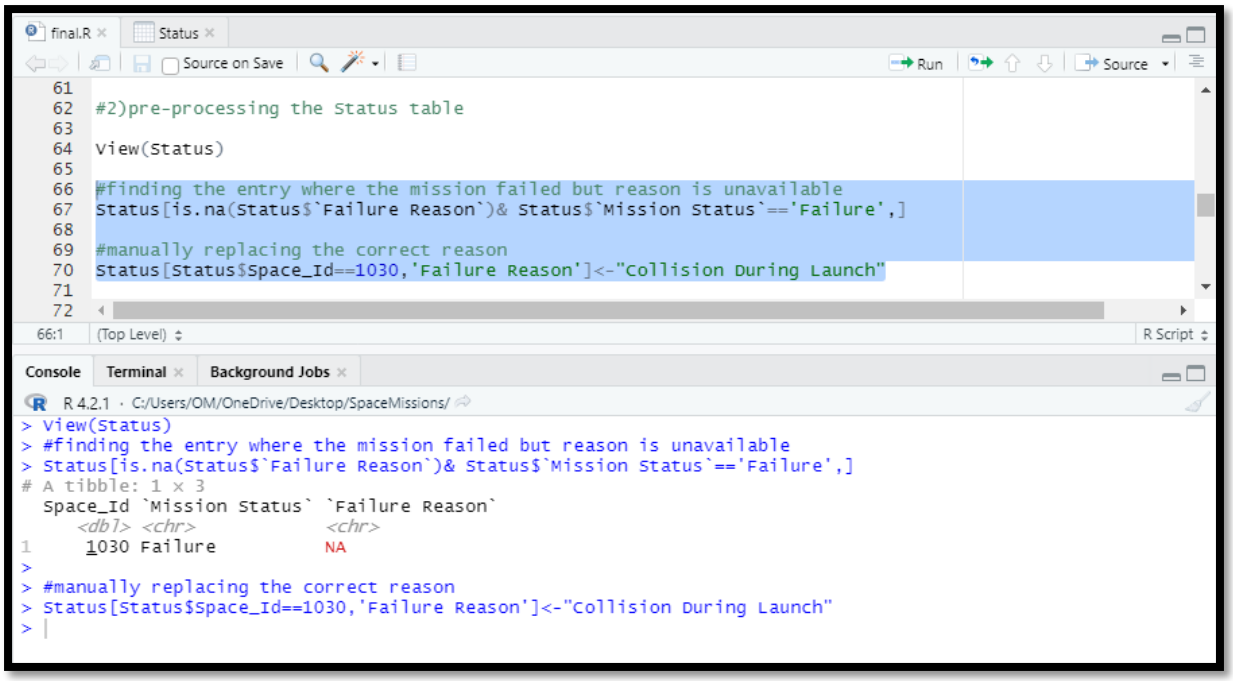
Status :

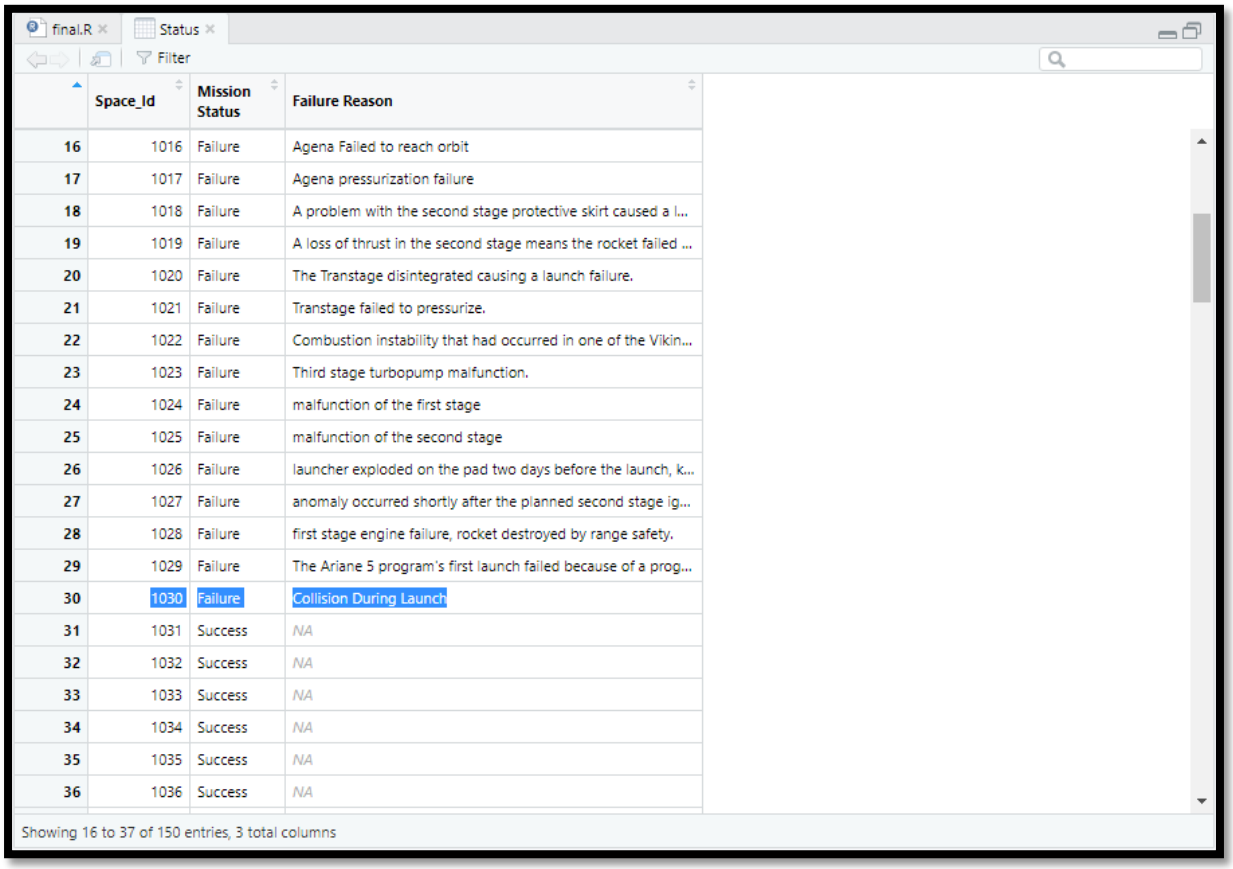
final.R × Status ×

Filter

	Space_Id	Mission Status	Failure Reason
16	1016	Failure	Agena Failed to reach orbit
17	1017	Failure	Agena pressurization failure
18	1018	Failure	A problem with the second stage protective skirt caused a l...
19	1019	Failure	A loss of thrust in the second stage means the rocket failed ...
20	1020	Failure	The Transtage disintegrated causing a launch failure.
21	1021	Failure	Transtage failed to pressurize.
22	1022	Failure	Combustion instability that had occurred in one of the Vikin...
23	1023	Failure	Third stage turbopump malfunction.
24	1024	Failure	malfunction of the first stage
25	1025	Failure	malfunction of the second stage
26	1026	Failure	launcher exploded on the pad two days before the launch, k...
27	1027	Failure	anomaly occurred shortly after the planned second stage ig...
28	1028	Failure	first stage engine failure, rocket destroyed by range safety.
29	1029	Failure	The Ariane 5 program's first launch failed because of a prog...
30	1030	Failure	NA
31	1031	Success	NA
32	1032	Success	NA
33	1033	Success	NA
34	1034	Success	NA
35	1035	Success	NA
36	1036	Success	NA

Showing 16 to 37 of 150 entries, 3 total columns


final.R
Status
Source on Save
Run
Source
61
62 #2)pre-processing the Status table
63
64 View(Status)
65
66 #finding the entry where the mission failed but reason is unavailable
67 Status[is.na(Status$`Failure Reason`)& Status$`Mission Status`=='Failure',]
68
69 #manually replacing the correct reason
70 Status[Status$Space_Id==1030,'Failure Reason']<-"Collision During Launch"
71
72
66:1
(Top Level)
R Script
Console
Terminal
Background Jobs
R 4.2.1 · C:/Users/OM/OneDrive/Desktop/SpaceMissions/
> view(Status)
> #finding the entry where the mission failed but reason is unavailable
> Status[is.na(Status$`Failure Reason`)& Status$`Mission Status`=='Failure',]
A tibble: 1 × 3
Space_Id `Mission Status` `Failure Reason`
<dbl> <chr> <chr>
1 1030 Failure NA
>
> #manually replacing the correct reason
> Status[Status$Space_Id==1030,'Failure Reason']<-"Collision During Launch"
>


final.R
Status
Filter
Space_Id
Mission Status
Failure Reason
16 1016 Failure Agena Failed to reach orbit
17 1017 Failure Agena pressurization failure
18 1018 Failure A problem with the second stage protective skirt caused a l...
19 1019 Failure A loss of thrust in the second stage means the rocket failed ...
20 1020 Failure The Transtage disintegrated causing a launch failure.
21 1021 Failure Transtage failed to pressurize.
22 1022 Failure Combustion instability that had occurred in one of the Vikin...
23 1023 Failure Third stage turbopump malfunction.
24 1024 Failure malfunction of the first stage
25 1025 Failure malfunction of the second stage
26 1026 Failure launcher exploded on the pad two days before the launch, k...
27 1027 Failure anomaly occurred shortly after the planned second stage ig...
28 1028 Failure first stage engine failure, rocket destroyed by range safety.
29 1029 Failure The Ariane 5 program's first launch failed because of a prog...
30 1030 Failure Collision During Launch
31 1031 Success NA
32 1032 Success NA
33 1033 Success NA
34 1034 Success NA
35 1035 Success NA
36 1036 Success NA
Showing 16 to 37 of 150 entries, 3 total columns

Payload_Info:

final.R × Payload_Info ×

Filter

	Space_Id	Payload_Name	Payload_Type	Payload_Mass_kg	Payload_Orbit
1	1001	FalconSAT-2	Research Satellites	19.5	Low Earth Orbit
2	1002	DemoSat	Mass simulator	3800.0	Low Earth Orbit
3	1003	Trailblazer	Communication Satellite	NA	Low Earth Orbit
4	1004	PRESat, NanoSail-D	Research Satellites	8.0	Low Earth Orbit
5	1005	Explorers	Human Remains	5.0	Low Earth Orbit
6	1006	Orbcomm-OG2	Communication Satellite	150.0	Low Earth Orbit
7	1007	SpaceX CRS-7	Space Station Supplies	1952.0	Low Earth Orbit
8	1008	Amos-6	Communication Satellite	5500.0	Geostationary Transfer Orbit
9	1009	Koreasat 1	Communication Satellite	711.0	Geostationary Transfer Orbit
10	1010	GPS IIR-1	Global Positioning System	2030.0	Medium Earth Orbit
11	1011	Galaxy 10	Communication Satellite	700.0	Geostationary Transfer Orbit
12	1012	Orion 3	Communication Satellite	NA	Geostationary Transfer Orbit
13	1013	DemoSat / 3CS-1 & 2	Research Satellites	NA	Geostationary Transfer Orbit
14	1014	Landsat 6	Enhanced Thematic Mapper	2750.0	Sun-Synchronous Orbit
15	1015	IDCSP GGTS-2	Gravity Gradient Test Satellite	47.0	Low Earth Orbit
16	1016	KH-8 no. 39	Reconnaissance Satellites	3000.0	Low Earth Orbit

Showing 1 to 17 of 150 entries, 5 total columns

final.R × Payload_Info ×

Source on Save | Run | Source

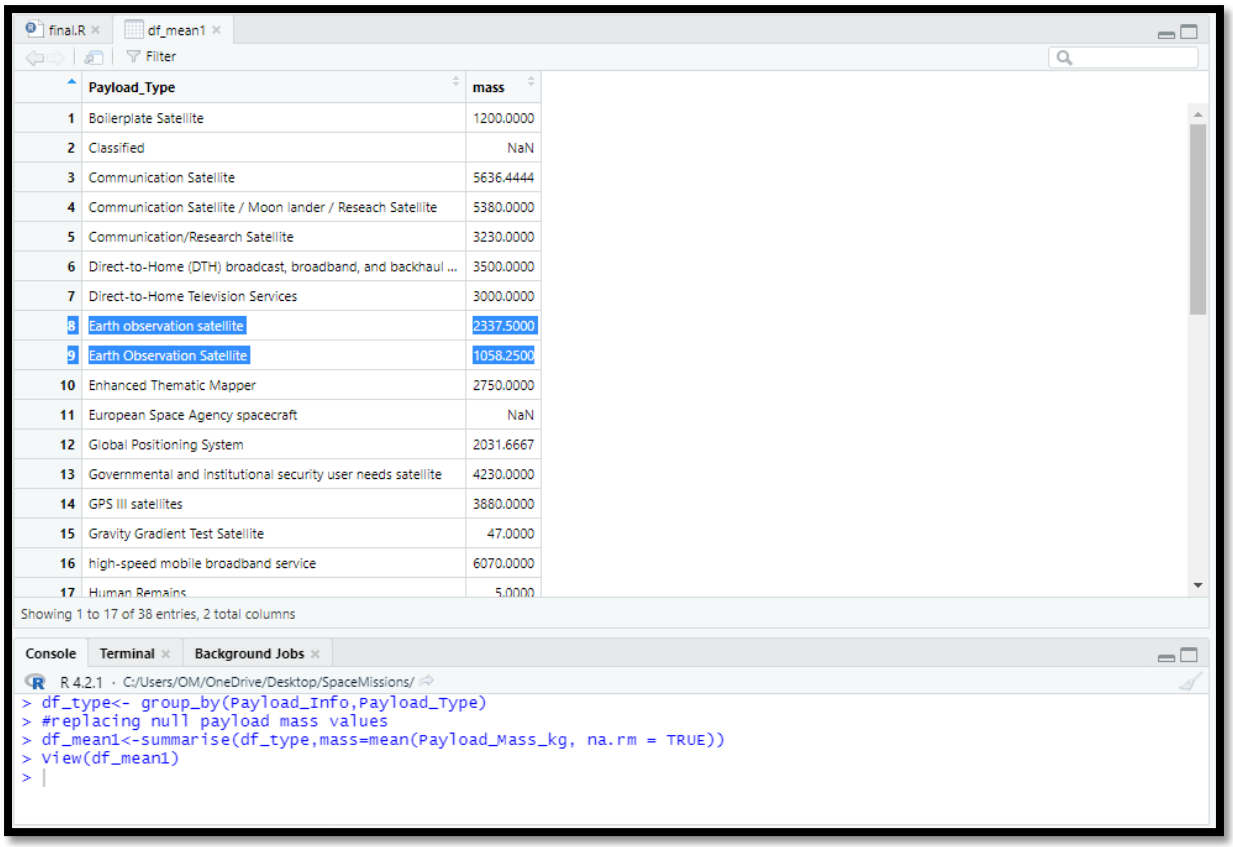
```
71
72  #3)pre-processing the Payload_Info table
73
74  Payload_Info[is.na(Payload_Info$`Payload_Type`),]$`Payload_Name`
75  Payload_Info[Payload_Info$`Payload_Name`=="RatSat (DemoSat)",]
76  Payload_Info[Payload_Info$`Payload_Name`=="RatSat (DemoSat)",3]<-"Mass simulator"
77  Payload_Info[Payload_Info$`Payload_Name`=="Dragon Spacecraft Qualification Unit",]
78  Payload_Info[Payload_Info$`Payload_Name`=="Dragon Spacecraft Qualification Unit",3]<-"Boilerplate Satelli
79
80
81
```

74:1 (Top Level) R Script

Console Terminal × Background Jobs ×

R 4.2.1 · C:/Users/OM/OneDrive/Desktop/SpaceMissions/

```
> Payload_Info[is.na(Payload_Info$`Payload_Type`),]$`Payload_Name`
[1] "RatSat (DemoSat)"                  "Dragon Spacecraft Qualification Unit"
>
```



final.R | df_mean1

Filter

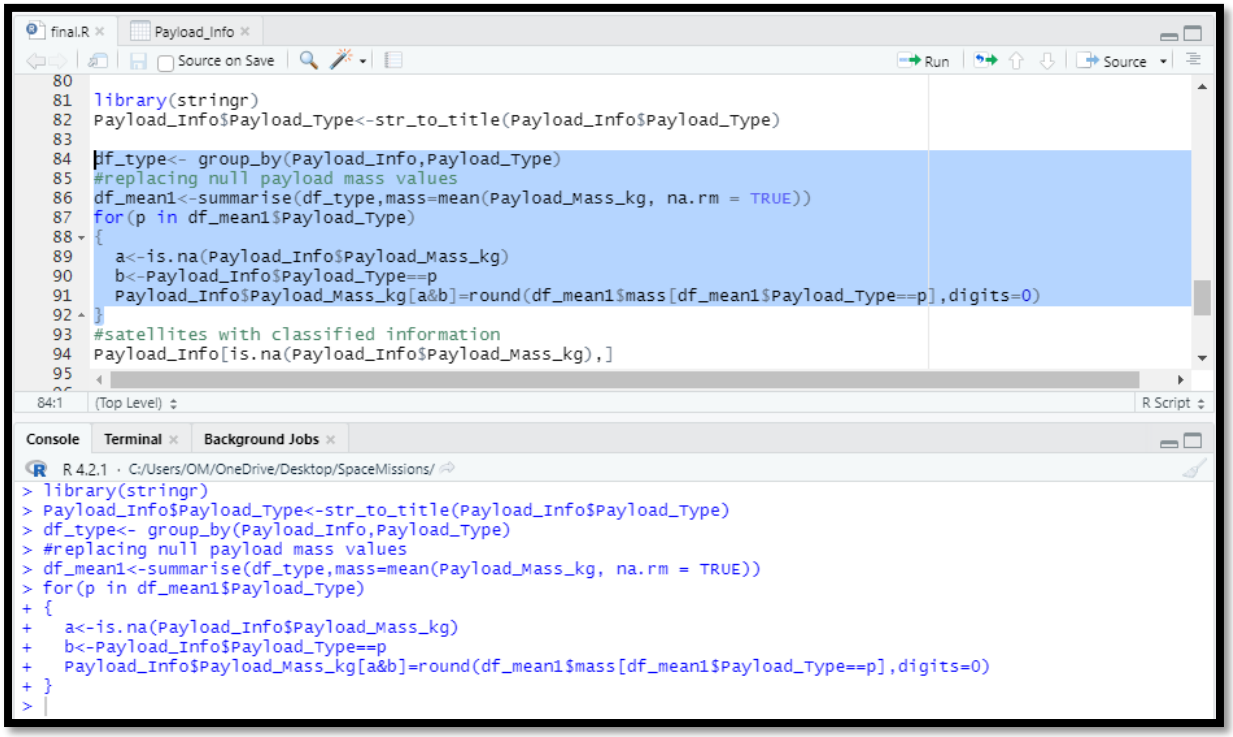
	Payload_Type	mass
1	Boilerplate Satellite	1200.0000
2	Classified	NaN
3	Communication Satellite	5636.4444
4	Communication Satellite / Moon lander / Reseach Satellite	5380.0000
5	Communication/Research Satellite	3230.0000
6	Direct-to-Home (DTH) broadcast, broadband, and backhaul ...	3500.0000
7	Direct-to-Home Television Services	3000.0000
8	Earth observation satellite	2337.5000
9	Earth Observation Satellite	1058.2500
10	Enhanced Thematic Mapper	2750.0000
11	European Space Agency spacecraft	NaN
12	Global Positioning System	2031.6667
13	Governmental and institutional security user needs satellite	4230.0000
14	GPS III satellites	3880.0000
15	Gravity Gradient Test Satellite	47.0000
16	high-speed mobile broadband service	6070.0000
17	Human Remains	5.0000

Showing 1 to 17 of 38 entries, 2 total columns

Console | Terminal | Background Jobs

R 4.2.1 · C:/Users/OM/OneDrive/Desktop/SpaceMissions/

```
> df_type<- group_by(Payload_Info,Payload_Type)
> #replacing null payload mass values
> df_mean1<-summarise(df_type,mass=mean(Payload_Mass_kg, na.rm = TRUE))
> View(df_mean1)
>
```



final.R | Payload_Info

Source on Save | Run | Source

```
80
81  library(stringr)
82  Payload_Info$Payload_Type<-str_to_title(Payload_Info$Payload_Type)
83
84  df_type<- group_by(Payload_Info,Payload_Type)
85  #replacing null payload mass values
86  df_mean1<-summarise(df_type,mass=mean(Payload_Mass_kg, na.rm = TRUE))
87  for(p in df_mean1$Payload_Type)
88  {
89    a<-is.na(Payload_Info$Payload_Mass_kg)
90    b<-Payload_Info$Payload_Type==p
91    Payload_Info$Payload_Mass_kg[a&b]=round(df_mean1$mass[df_mean1$Payload_Type==p],digits=0)
92  }
93  #satellites with classified information
94  Payload_Info[is.na(Payload_Info$Payload_Mass_kg),]
95
```

84:1 (Top Level) R Script

Console | Terminal | Background Jobs

R 4.2.1 · C:/Users/OM/OneDrive/Desktop/SpaceMissions/

```
> library(stringr)
> Payload_Info$Payload_Type<-str_to_title(Payload_Info$Payload_Type)
> df_type<- group_by(Payload_Info,Payload_Type)
> #replacing null payload mass values
> df_mean1<-summarise(df_type,mass=mean(Payload_Mass_kg, na.rm = TRUE))
> for(p in df_mean1$Payload_Type)
+ {
+   a<-is.na(Payload_Info$Payload_Mass_kg)
+   b<-Payload_Info$Payload_Type==p
+   Payload_Info$Payload_Mass_kg[a&b]=round(df_mean1$mass[df_mean1$Payload_Type==p],digits=0)
+ }
>
```

```
93  #satellites with classified information
94  Payload_Info[is.na(Payload_Info$Payload_Mass_kg),]
95
93:1  (Top Level)                                                    R Script

Console  Terminal  Background Jobs

R 4.2.1 · C:/Users/OM/OneDrive/Desktop/SpaceMissions/

> #satellites with classified information
> Payload_Info[is.na(Payload_Info$Payload_Mass_kg),]
# A tibble: 3 × 5
  Space_Id Payload_Name Payload_Type                    Payload_Mass_kg Payload_Orbit
     <dbl> <chr>        <chr>                                    <dbl> <chr>
1     1029 Cluster      European Space Agency Spacecraft           NaN High Earth Orbit
2     1066 NROL-76      Classified                                 NaN Low Earth Orbit
3     1080 Zuma         Classified                                 NaN Low Earth Orbit
>
```

final.R × Payload_Info ×

Filter

	Space_Id	Payload_Name	Payload_Type	Payload_Mass_kg	Payload_Orbit
1	1001	FalconSAT-2	Research Satellites	19.5	Low Earth Orbit
2	1002	DemoSat	Mass Simulator	3800.0	Low Earth Orbit
3	1003	Trailblazer	Communication Satellite	5636.0	Low Earth Orbit
4	1004	PRESat, NanoSail-D	Research Satellites	8.0	Low Earth Orbit
5	1005	Explorers	Human Remains	5.0	Low Earth Orbit
6	1006	Orbcomm-OG2	Communication Satellite	150.0	Low Earth Orbit
7	1007	SpaceX CRS-7	Space Station Supplies	1952.0	Low Earth Orbit
8	1008	Amos-6	Communication Satellite	5500.0	Geostationary Transfer Orbit
9	1009	Koreasat 1	Communication Satellite	711.0	Geostationary Transfer Orbit
10	1010	GPS IIR-1	Global Positioning System	2030.0	Medium Earth Orbit
11	1011	Galaxy 10	Communication Satellite	700.0	Geostationary Transfer Orbit
12	1012	Orion 3	Communication Satellite	5636.0	Geostationary Transfer Orbit
13	1013	DemoSat / 3CS-1 & 2	Research Satellites	1113.0	Geostationary Transfer Orbit
14	1014	Landsat 6	Enhanced Thematic Mapper	2750.0	Sun-Synchronous Orbit
15	1015	IDCSP GGTS-2	Gravity Gradient Test Satellite	47.0	Low Earth Orbit
16	1016	KH-8 no. 39	Reconnaissance Satellites	3000.0	Low Earth Orbit
17	1017	KH-8 no. 35	Reconnaissance Satellites	3000.0	Low Earth Orbit
18	1018	KH-8 Gambit no.06	Reconnaissance Satellites	3000.0	Polar Orbit
19	1019	KH-8 Gambit no.05	Reconnaissance Satellites	3000.0	Polar Orbit
20	1020	LCS-2	Research Satellites	1113.0	Low Earth Orbit
21	1021	Transtage 1	None	0.0	Low Earth Orbit
22	1022	CAT-2 / Amsat P3A / Firewheel Subsat	Communication Satellite	5636.0	Geostationary Transfer Orbit

Showing 1 to 22 of 150 entries, 5 total columns

Satellite Info:

final.R | Satellite_Info

Filter

	Space_Id	Vehicle_Type	Liftoff_Thrust_kN	Payload_to_Orbit_kg	Rocket_Height_m	Fairing_Diameter_m
1	1001	Falcon 1	343	470	22.25	1.50
2	1002	Falcon 1	343	470	22.25	1.50
3	1003	Falcon 1	NA	470	22.25	1.50
4	1004	Falcon 1	343	470	22.25	1.50
5	1005	Falcon 1	343	470	22.25	1.50
6	1006	Falcon 9 (v1.0)	4940	10450	54.90	5.20
7	1007	Falcon 9 (v1.1)	5885	13150	68.40	5.20
8	1008	Falcon 9 Full Thrust (v1.2)	6804	8300	70.00	5.20
9	1009	Delta II 7925	NA	1819	38.10	2.90
10	1010	Delta II 7925	3511	1819	38.10	2.90
11	1011	Delta III 8930	628	3810	35.00	4.00
12	1012	Delta III 8930	628	3810	35.00	4.00
13	1013	Delta IV Heavy	9411	28370	72.00	5.10
14	1014	Titan II(23)G	1900	3600	42.90	3.00
15	1015	Titan IIIC	13642	13100	42.00	3.00
16	1016	Titan III(24)B	2410	4000	50.00	3.00
17	1017	Titan III(24)B	2410	4000	50.00	3.00
18	1018	Titan IIIB	NA	3300	45.00	1.52
19	1019	Titan IIIB	2300	3300	45.00	1.52
20	1020	Titan IIIC	13642	13100	42.00	3.00
21	1021	Titan IIIA	1936	3100	42.00	3.00
22	1022	Ariane 1	NA	1850	50.00	2.60

Showing 1 to 22 of 150 entries, 6 total columns

final.R* | df_mean1 | Satellite_Info

Source on Save | Run | Source

```
95
96  #4)pre-processing the Satellite_Info table
97
98  df_type<- group_by(Satellite_Info,Vehicle_Type)
99  #replacing null thrust values
100 df_mean2<-summarise(df_type,thrust=mean(Liftoff_Thrust_kN, na.rm = TRUE))
101 for(q in df_mean2$Vehicle_Type)
102 {
103   a<-is.na(Satellite_Info$Liftoff_Thrust_kN)
104   b<-Satellite_Info$Vehicle_Type==q
105   Satellite_Info$Liftoff_Thrust_kN[a&b]=round(df_mean2$thrust[df_mean2$Vehicle_Type==q],digits=0)
106 }
107
108
```

101:1 (Top Level) R Script

Console | Terminal | Background Jobs

R 4.2.1 · C:/Users/OM/OneDrive/Desktop/SpaceMissions/

```
> for(q in df_mean2$Vehicle_Type)
+ {
+   a<-is.na(Satellite_Info$Liftoff_Thrust_kN)
+   b<-Satellite_Info$Vehicle_Type==q
+   Satellite_Info$Liftoff_Thrust_kN[a&b]=round(df_mean2$thrust[df_mean2$Vehicle_Type==q],digits=0)
+ }
>
```

final.R* × Satellite_Info ×

Filter

	Space_Id	Vehicle_Type	Liftoff_Thrust_kN	Payload_to_Orbit_kg	Rocket_Height_m	Fairing_Diameter_m
1	1001	Falcon 1	343	470	22.25	1.50
2	1002	Falcon 1	343	470	22.25	1.50
3	1003	Falcon 1	343	470	22.25	1.50
4	1004	Falcon 1	343	470	22.25	1.50
5	1005	Falcon 1	343	470	22.25	1.50
6	1006	Falcon 9 (v1.0)	4940	10450	54.90	5.20
7	1007	Falcon 9 (v1.1)	5885	13150	68.40	5.20
8	1008	Falcon 9 Full Thrust (v1.2)	6804	8300	70.00	5.20
9	1009	Delta II 7925	3511	1819	38.10	2.90
10	1010	Delta II 7925	3511	1819	38.10	2.90
11	1011	Delta III 8930	628	3810	35.00	4.00
12	1012	Delta III 8930	628	3810	35.00	4.00
13	1013	Delta IV Heavy	9411	28370	72.00	5.10
14	1014	Titan II(23)G	1900	3600	42.90	3.00
15	1015	Titan IIIC	13642	13100	42.00	3.00
16	1016	Titan III(24)B	2410	4000	50.00	3.00
17	1017	Titan III(24)B	2410	4000	50.00	3.00
18	1018	Titan IIIB	2300	3300	45.00	1.52
19	1019	Titan IIIB	2300	3300	45.00	1.52
20	1020	Titan IIIC	13642	13100	42.00	3.00
21	1021	Titan IIIA	1936	3100	42.00	3.00
22	1022	Ariane 1	2772	1850	50.00	2.60

Showing 1 to 22 of 150 entries, 6 total columns

Final Tables:

1) What are the average temperature details of the launch sites?

2) What are the average Wind Speeds details of the launch sites?

3) What are the average Humidity details of the launch sites?

final.R × Station_Info ×

Filter

	Space_Id	Company	LaunchDate	LaunchTime	LaunchSite	Temperature	WindSpeed	Humidity
1	1001	SpaceX	2006-03-24	22:30:00	Marshall Islands	86	9	74
2	1002	SpaceX	2007-03-21	01:10:00	Marshall Islands	88	8	75
3	1003	SpaceX	2008-08-03	03:34:00	Marshall Islands	87	9	74
4	1004	SpaceX	2008-08-03	03:34:00	Marshall Islands	87	9	74
5	1005	SpaceX	2008-08-03	03:34:00	Marshall Islands	87	9	74
6	1006	SpaceX	2012-10-08	00:35:00	Cape Canaveral	77	5	100
7	1007	SpaceX	2015-06-28	14:21:00	Cape Canaveral	93	10	42
8	1008	SpaceX	2016-09-01	13:07:00	Cape Canaveral	87	15	80
9	1009	Boeing	1995-09-05	11:10:00	Cape Canaveral	84	10	60
10	1010	Boeing	1997-01-17	16:28:00	Cape Canaveral	50	12	62
11	1011	Boeing	1998-08-27	01:17:00	Cape Canaveral	82	7	89
12	1012	Boeing	1999-05-05	01:00:00	Cape Canaveral	70	8	64
13	1013	Boeing	2004-12-21	21:50:00	Cape Canaveral	62	5	83
14	1014	Martin Marietta	1993-10-05	17:56:00	Vandenberg	62	12	89
15	1015	US Air Force	1996-08-26	13:59:00	Cape Canaveral	90	12	70
16	1016	US Air Force	1973-06-26	14:45:00	Vandenberg	50	10	80
17	1017	US Air Force	1972-05-20	15:30:00	Vandenberg	64	20	46
18	1018	US Air Force	1967-06-20	16:19:00	Vandenberg	60	15	80
19	1019	US Air Force	1967-04-26	15:25:00	Vandenberg	56	12	75

Showing 1 to 20 of 150 entries, 8 total columns

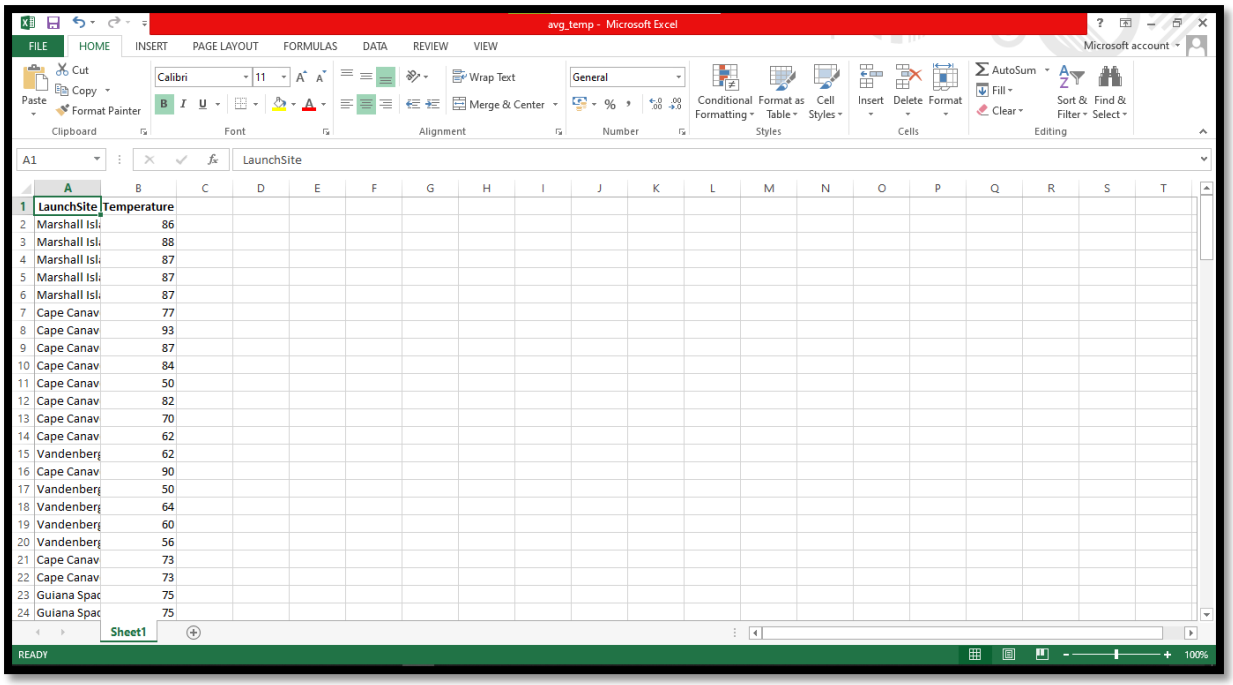
```
108 #exporting the final data frame to excel file
109 library("writexl")
110
111 #Q1) what are the average temperature details of the launch sites?
112 avg_temp<-Station_Info[,c(5,6)]
113 write_xlsx(avg_temp,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\avg_temp.xlsx")
114
115 #Q2) what are the average Wind Speeds details of the launch sites?
116 avg_wind<-Station_Info[,c(5,7)]
117 write_xlsx(avg_wind,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\avg_wind.xlsx")
118
119 #Q3)what are the average Humidity details of the launch sites?
120 avg_hum<-Station_Info[,c(5,8)]
121 write_xlsx(avg_hum,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\avg_hum.xlsx")
122
123
```

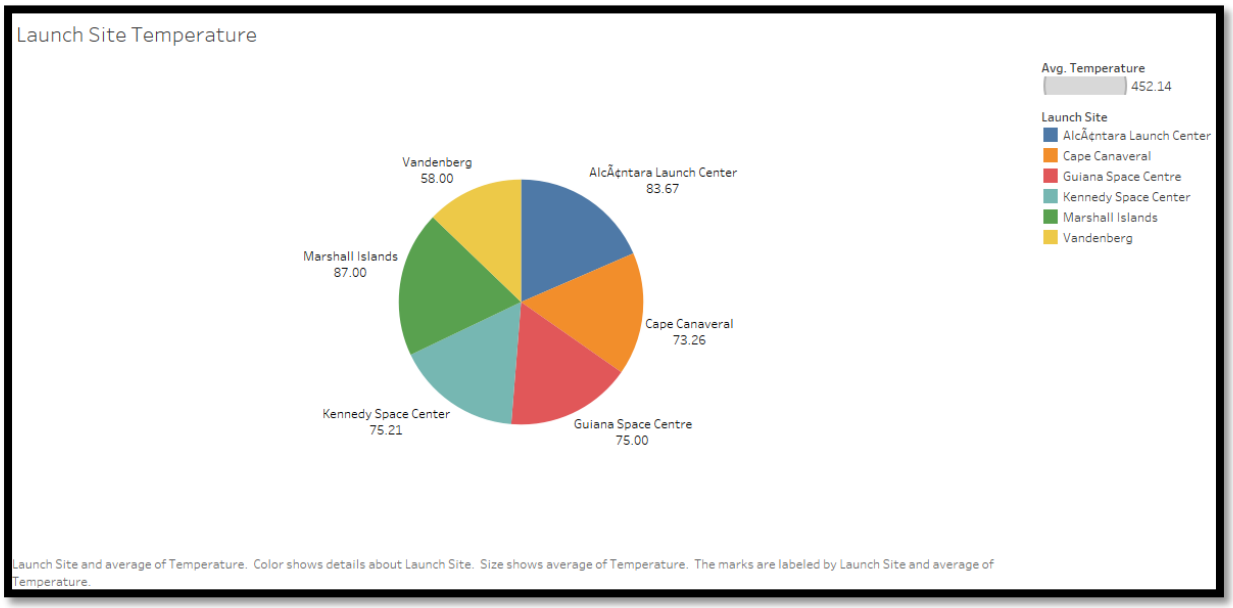
107:1 (Top Level) R Script

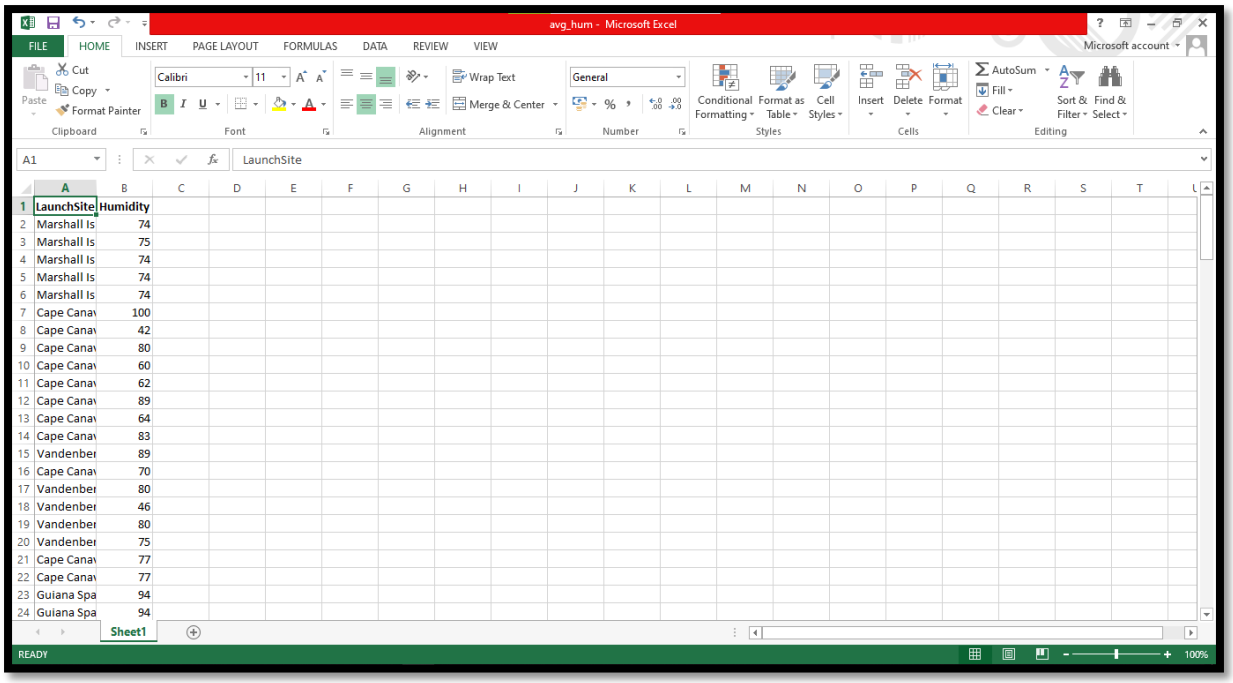
Console Terminal × Background Jobs ×

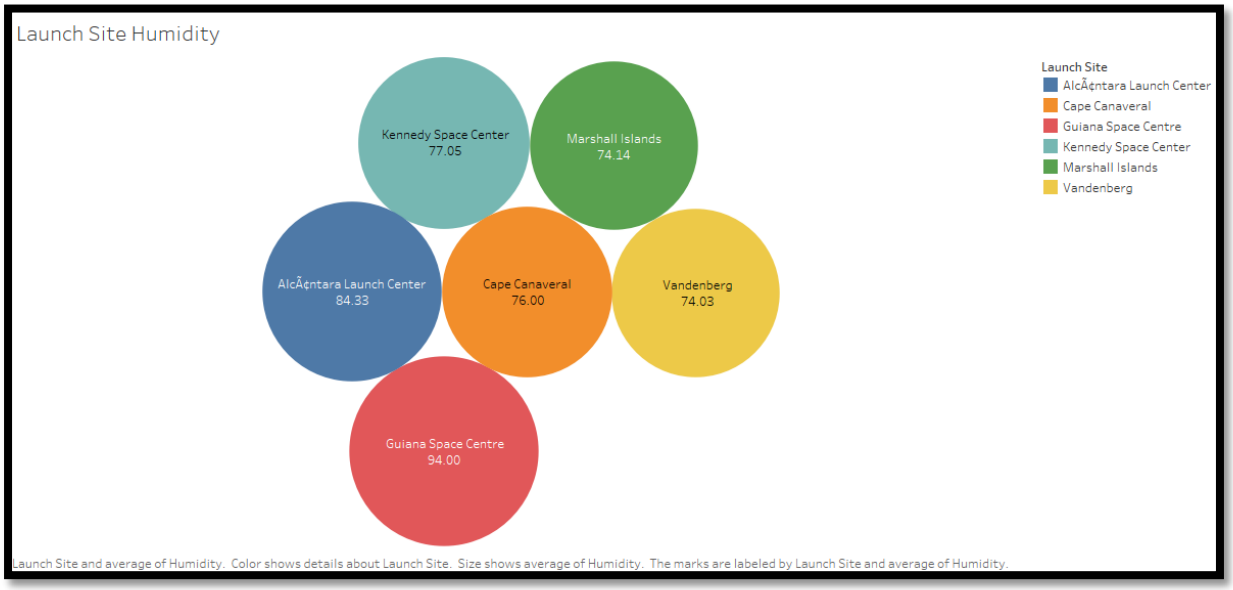
R 4.2.1 · C:/Users/OM/OneDrive/Desktop/SpaceMissions/

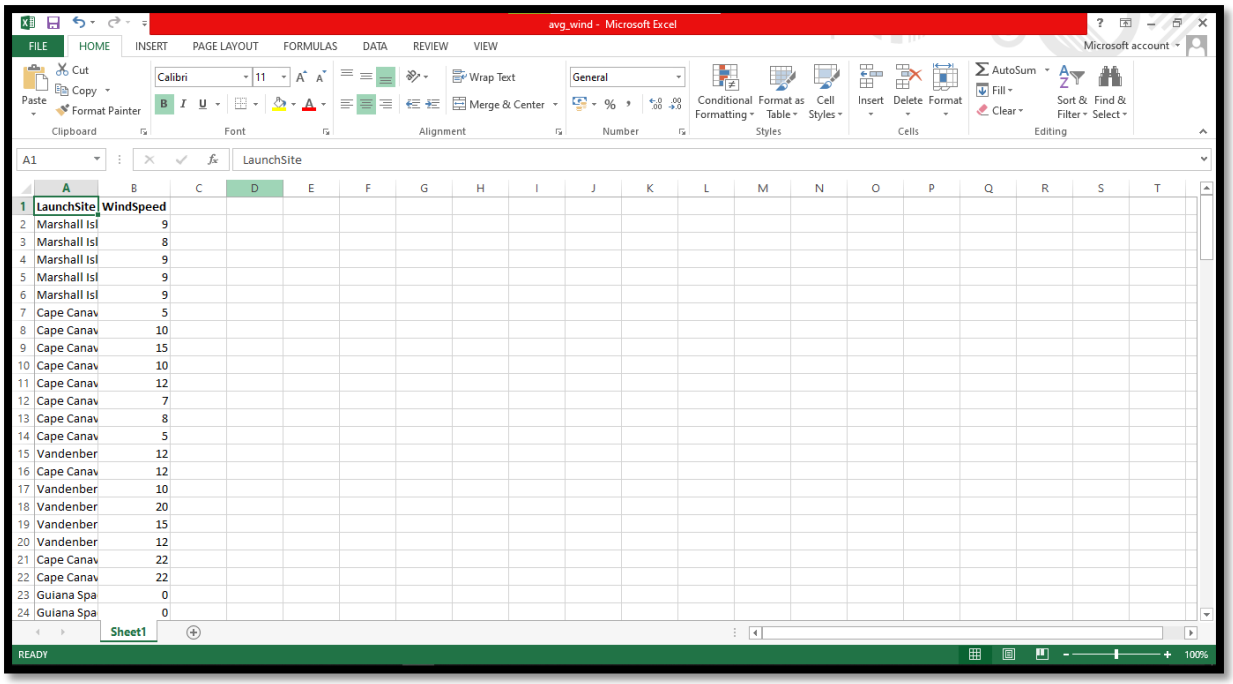
```
> library("writexl")
> write_xlsx(avg_temp,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\avg_temp.xlsx")
> write_xlsx(avg_wind,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\avg_wind.xlsx")
> write_xlsx(avg_hum,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\avg_hum.xlsx")
>
```


avg_temp - Microsoft Excel
FILE
HOME
INSERT
PAGE LAYOUT
FORMULAS
DATA
REVIEW
VIEW
Microsoft account
Paste
Cut
Copy
Format Painter
Clipboard
Calibri
11
Font
Wrap Text
Merge & Center
Alignment
General
Number
Conditional Formatting
Format as Table
Cell Styles
Styles
Insert
Delete
Format
Cells
AutoSum
Fill
Clear
Sort & Filter
Find & Select
Editing
A1
LaunchSite
LaunchSite Temperature
Marshall Isl 86
Marshall Isl 88
Marshall Isl 87
Marshall Isl 87
Marshall Isl 87
Cape Canav 77
Cape Canav 93
Cape Canav 87
Cape Canav 84
Cape Canav 50
Cape Canav 82
Cape Canav 70
Cape Canav 62
Vandenberg 62
Cape Canav 90
Vandenberg 50
Vandenberg 64
Vandenberg 60
Vandenberg 56
Cape Canav 73
Cape Canav 73
Guiana Spac 75
Guiana Spac 75
Sheet1
READY
100%


Launch Site Temperature
Avg. Temperature
452.14
Launch Site
AlcÃ¢ntara Launch Center
Cape Canaveral
Guiana Space Centre
Kennedy Space Center
Marshall Islands
Vandenberg
Vandenberg
58.00
AlcÃ¢ntara Launch Center
83.67
Marshall Islands
87.00
Cape Canaveral
73.26
Kennedy Space Center
75.21
Guiana Space Centre
75.00
Launch Site and average of Temperature. Color shows details about Launch Site. Size shows average of Temperature. The marks are labeled by Launch Site and average of Temperature.

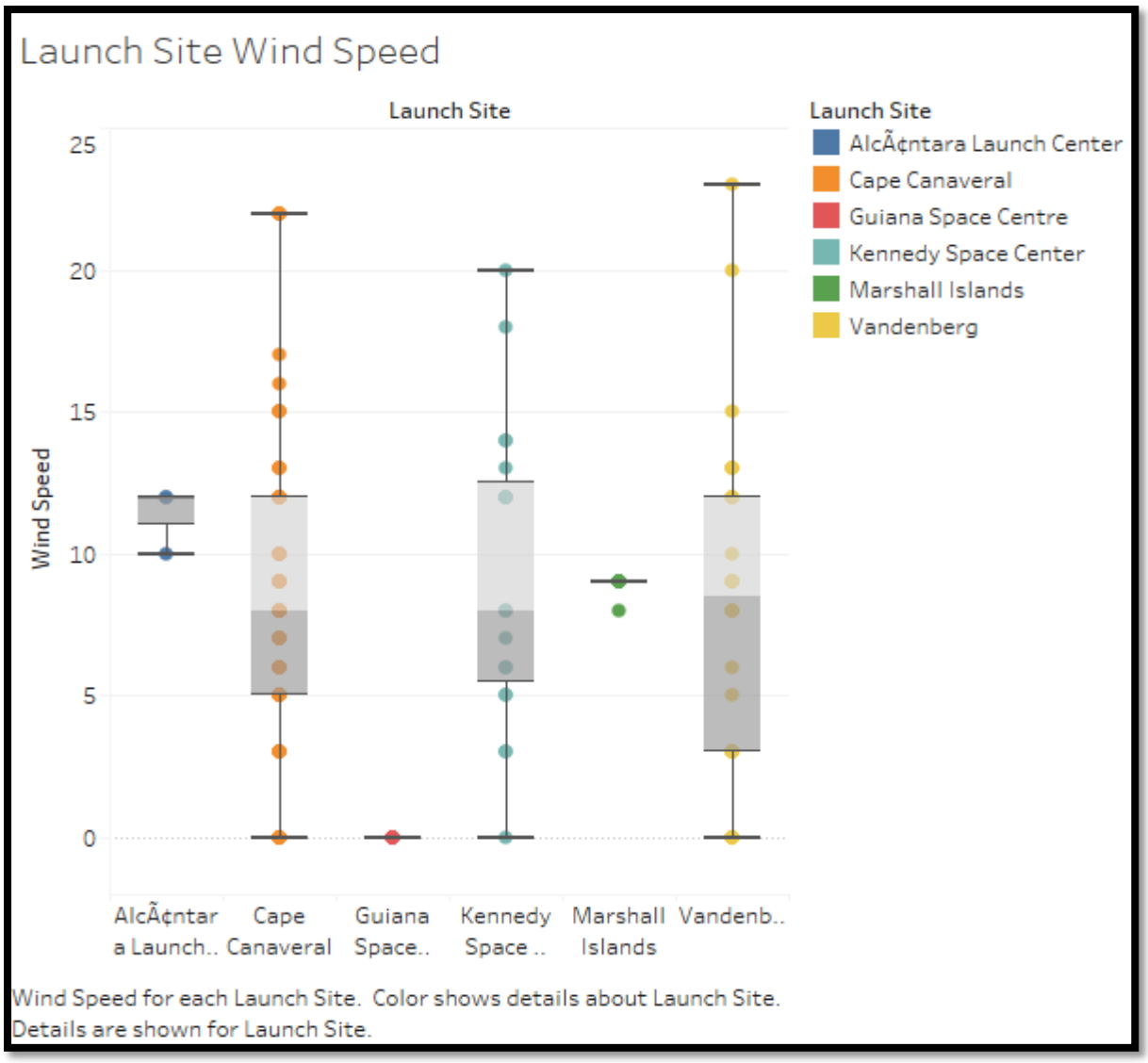

avg_hum - Microsoft Excel
FILE
HOME
INSERT
PAGE LAYOUT
FORMULAS
DATA
REVIEW
VIEW
Microsoft account
Cut
Copy
Format Painter
Paste
Calibri
11
Wrap Text
Merge & Center
General
Conditional Formatting
Format as Table
Cell Styles
Insert
Delete
Format
AutoSum
Fill
Clear
Sort & Filter
Find & Select
Clipboard
Font
Alignment
Number
Styles
Cells
Editing
A1
LaunchSite
LaunchSite Humidity
Marshall Is 74
Marshall Is 75
Marshall Is 74
Marshall Is 74
Marshall Is 74
Cape Canav 100
Cape Canav 42
Cape Canav 80
Cape Canav 60
Cape Canav 62
Cape Canav 89
Cape Canav 64
Cape Canav 83
Vandenber 89
Cape Canav 70
Vandenber 80
Vandenber 46
Vandenber 80
Vandenber 75
Cape Canav 77
Cape Canav 77
Guiana Spa 94
Guiana Spa 94
Sheet1
READY
100%


Launch Site Humidity
Kennedy Space Center
77.05
Marshall Islands
74.14
AlcÃ¢ntara Launch Center
84.33
Cape Canaveral
76.00
Vandenberg
74.03
Guiana Space Centre
94.00
Launch Site
AlcÃ¢ntara Launch Center
Cape Canaveral
Guiana Space Centre
Kennedy Space Center
Marshall Islands
Vandenberg
Launch Site and average of Humidity. Color shows details about Launch Site. Size shows average of Humidity. The marks are labeled by Launch Site and average of Humidity.



avg_wind - Microsoft Excel

	LaunchSite	WindSpeed
2	Marshall Isl	9
3	Marshall Isl	8
4	Marshall Isl	9
5	Marshall Isl	9
6	Marshall Isl	9
7	Cape Canav	5
8	Cape Canav	10
9	Cape Canav	15
10	Cape Canav	10
11	Cape Canav	12
12	Cape Canav	7
13	Cape Canav	8
14	Cape Canav	5
15	Vandenber	12
16	Cape Canav	12
17	Vandenber	10
18	Vandenber	20
19	Vandenber	15
20	Vandenber	12
21	Cape Canav	22
22	Cape Canav	22
23	Guiana Spa	0
24	Guiana Spa	0



4) What are the different varieties of launch vehicles used by different companies?

```
#Q4) What are the different varieties of launch vehicles used by different companies?
v1<-Station_Info[,2]
v2<-Satellite_Info[,2]
vehicle<-cbind(v1,v2)
write_xlsx(vehicle,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\vehicle_details.xlsx")
```

```
Console  Terminal  Background Jobs
R 4.2.1 · C:/Users/OM/OneDrive/Desktop/SpaceMissions/
> write_xlsx(vehicle,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\vehicle_details.xlsx")
> write_xlsx(vehicle,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\vehicle_details.xlsx")
>
```

vehicle_details - Microsoft Excel

Company	Vehicle_Type
SpaceX	Falcon 1
SpaceX	Falcon 1
SpaceX	Falcon 1
SpaceX	Falcon 1
SpaceX	Falcon 1
SpaceX	Falcon 9 (v1.0)
SpaceX	Falcon 9 (v1.1)
SpaceX	Falcon 9 Full Thrust (v1.2)
Boeing	Delta II 7925
Boeing	Delta II 7925
Boeing	Delta III 8930
Boeing	Delta III 8930
Boeing	Delta IV Heavy
Martin Ma	Titan II(23)G
US Air For	Titan IIIC
US Air For	Titan III(24)B
US Air For	Titan III(24)B
US Air For	Titan IIIB
US Air For	Titan IIIB
US Air For	Titan IIIC
US Air For	Titan IIIA
European	Ariane 1
European	Ariane 1

Satellite Details

Company	Vehicle Type
Arianespace	Ariane 5 ECA
	Ariane 5 G
	Ariane 42P
	Vega
Boeing	Delta II 7320-10C
	Delta II 7326
	Delta II 7420-10C
	Delta II 7425
	Delta II 7425-10C
	Delta II 7426
	Delta II 7920-10
	Delta II 7920-10C
	Delta II 7925
	Delta III 8930
	Delta IV Heavy
	Delta IV Medium+ (4,2)
Brazilian Space Agency	VLS-1
European Space Agency	Ariane 1
Martin Marietta	Titan II(23)G
SpaceX	Falcon 1
	Falcon 9 (v1.0)
	Falcon 9 (v1.1)
	Falcon 9 Block 3
	Falcon 9 Block 4
	Falcon 9 Block 5
	Falcon 9 Full Thrust (v1.2)
	Falcon Heavy
US Air Force	Titan III(24)B
	Titan IIIA
	Titan IIIB
	Titan IIIC

Company
- Arianespace
- Boeing
- Brazilian Space Agency
- European Space Agency
- Martin Marietta
- SpaceX
- US Air Force

Company (color) broken down by Company and Vehicle Type.

5) What is the Mission Status of the companies?

6) Track Records of the Launch Sites.

```
129 #Q5) What is the Mission Status of the companies?
130
131 #Q6) Track Records of the Launch Sites.
132
133 #compilation of the given data into one data frame using inner join
134 df1<-merge(Station_Info,Satellite_Info,by="Space_Id")
135 df2<-merge(Payload_Info,Status,by="Space_Id")
136
137 SpaceMissions<-merge(df1,df2,by="Space_Id")
138
139 write_xlsx(Station_Info,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\SpaceMissions.xlsx")
```

139:1 (Top Level) R Script

Console Terminal Background Jobs

R 4.2.1 · C:/Users/OM/OneDrive/Desktop/SpaceMissions/

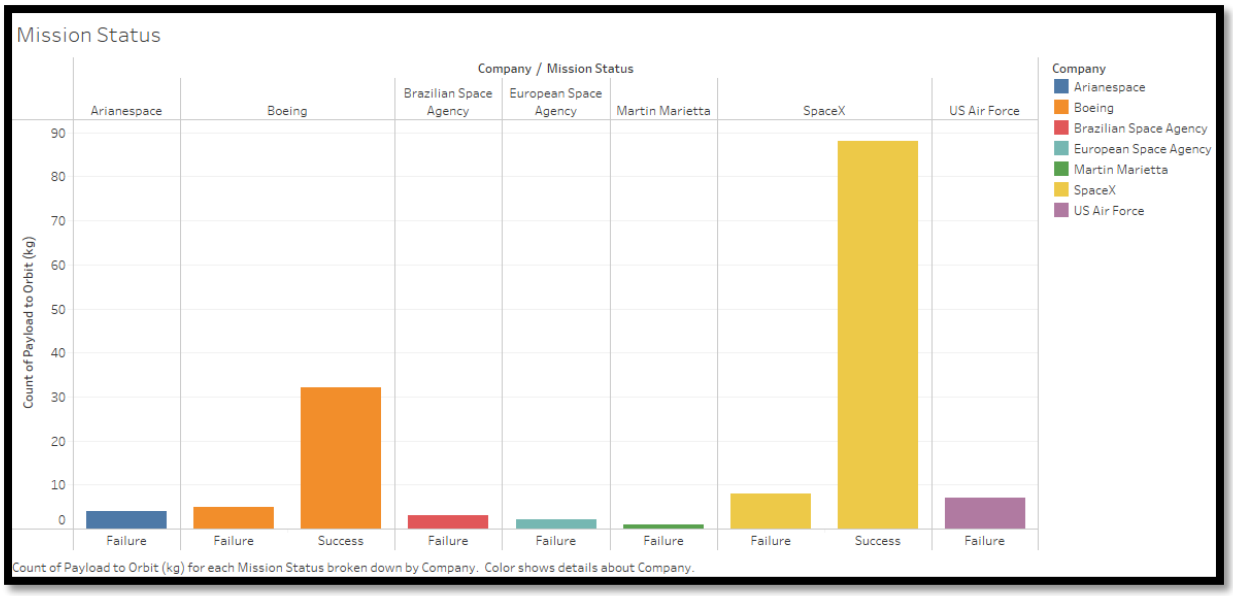
```
> write_xlsx(Station_Info,"C:\\Users\\OM\\OneDrive\\Desktop\\SpaceMissions\\SpaceMissions.xlsx")
>
```

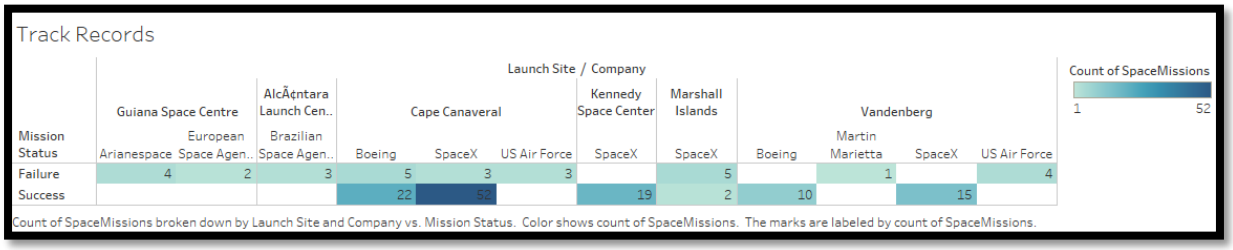
finalR* SpaceMissions

Filter

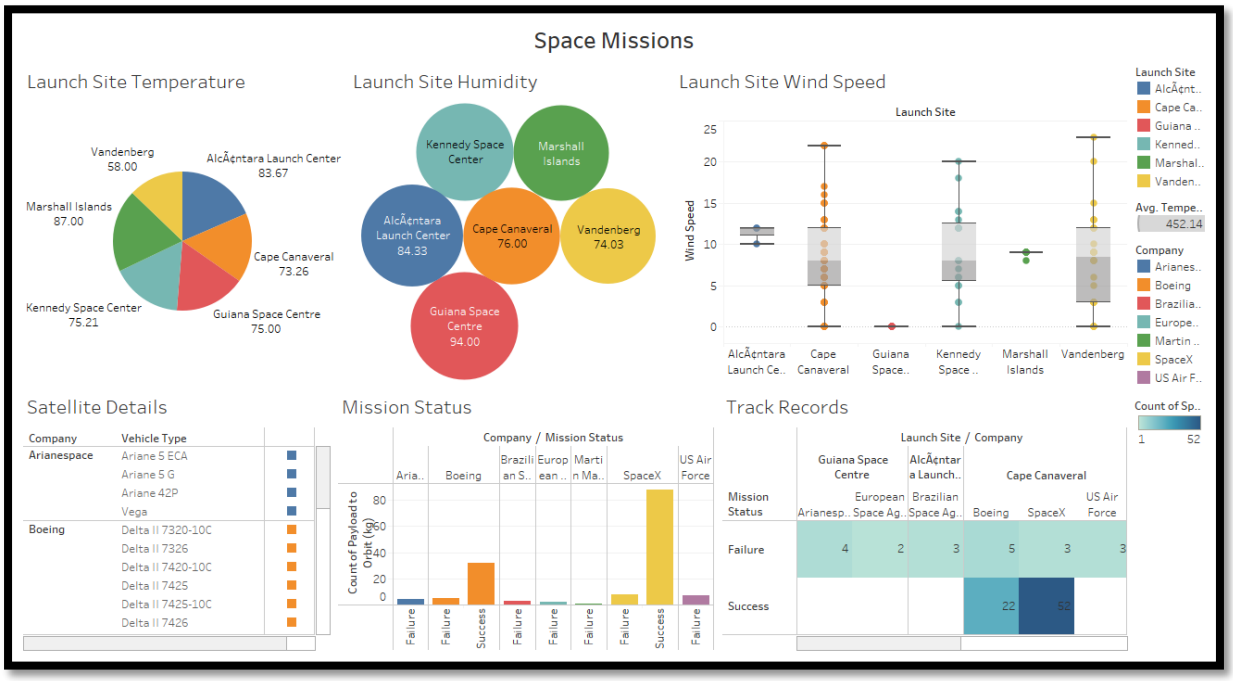
	Space_Id	Company	LaunchDate	LaunchTime	LaunchSite	Temperature	WindSpeed	Humidity	Vehicle_Type	Liftoff_Thrust_kN	Payload_to_Orbit_kg	Rocket_Height_m
1	1001	SpaceX	2006-03-24	22:30:00	Marshall Islands	86	9	74	Falcon 1	343	470	22
2	1002	SpaceX	2007-03-21	01:10:00	Marshall Islands	88	8	75	Falcon 1	343	470	22
3	1003	SpaceX	2008-08-03	03:34:00	Marshall Islands	87	9	74	Falcon 1	343	470	22
4	1004	SpaceX	2008-08-03	03:34:00	Marshall Islands	87	9	74	Falcon 1	343	470	22
5	1005	SpaceX	2008-08-03	03:34:00	Marshall Islands	87	9	74	Falcon 1	343	470	22
6	1006	SpaceX	2012-10-08	00:35:00	Cape Canaveral	77	5	100	Falcon 9 (v1.0)	4940	10450	54
7	1007	SpaceX	2015-06-28	14:21:00	Cape Canaveral	93	10	42	Falcon 9 (v1.1)	5885	13150	68
8	1008	SpaceX	2016-09-01	13:07:00	Cape Canaveral	87	15	80	Falcon 9 Full Thrust (v1.2)	6804	8300	70
9	1009	Boeing	1995-09-05	11:10:00	Cape Canaveral	84	10	60	Delta II 7925	3511	1819	38
10	1010	Boeing	1997-01-17	16:28:00	Cape Canaveral	50	12	62	Delta II 7925	3511	1819	38
11	1011	Boeing	1998-08-27	01:17:00	Cape Canaveral	82	7	89	Delta III 8930	628	3810	35
12	1012	Boeing	1999-05-05	01:00:00	Cape Canaveral	70	8	64	Delta III 8930	628	3810	35
13	1013	Boeing	2004-12-21	21:50:00	Cape Canaveral	62	5	83	Delta IV Heavy	9411	28370	72
14	1014	Martin Marietta	1993-10-05	17:56:00	Vandenberg	62	12	89	Titan II(23)G	1900	3600	42
15	1015	US Air Force	1996-08-26	13:59:00	Cape Canaveral	90	12	70	Titan IIIC	13642	13100	42
16	1016	US Air Force	1973-06-26	14:45:00	Vandenberg	50	10	80	Titan III(24)B	2410	4000	50
17	1017	US Air Force	1972-05-20	15:30:00	Vandenberg	64	20	46	Titan III(24)B	2410	4000	50
18	1018	US Air Force	1967-06-20	16:19:00	Vandenberg	60	15	80	Titan IIIB	2300	3300	45
19	1019	US Air Force	1967-04-26	15:25:00	Vandenberg	56	12	75	Titan IIIB	2300	3300	45
20	1020	US Air Force	1965-10-15	17:23:00	Cape Canaveral	73	22	77	Titan IIIC	13642	13100	42
21	1021	US Air Force	1964-09-01	15:00:00	Cape Canaveral	73	22	77	Titan IIIA	1036	3100	42

Showing 1 to 21 of 150 entries, 19 total columns


Mission Status
Company / Mission Status
Arianespace
Boeing
Brazilian Space Agency
European Space Agency
Martin Marietta
SpaceX
US Air Force
Company
Arianespace
Boeing
Brazilian Space Agency
European Space Agency
Martin Marietta
SpaceX
US Air Force
Count of Payload to Orbit (kg)
90
80
70
60
50
40
30
20
10
0
Failure
Failure
Success
Failure
Failure
Failure
Failure
Success
Failure
Count of Payload to Orbit (kg) for each Mission Status broken down by Company. Color shows details about Company.


Track Records
Launch Site / Company
Guiana Space Centre
AlcÃ¢ntara Launch Cen..
Cape Canaveral
Kennedy Space Center
Marshall Islands
Vandenberg
Mission Status
Arianespace
European Space Agen..
Brazilian Space Agen..
Boeing
SpaceX
US Air Force
SpaceX
SpaceX
Boeing
Martin Marietta
SpaceX
US Air Force
Failure 4 2 3 5 3 3 5 1 4
Success 22 52 19 2 10 15
Count of SpaceMissions
1
52
Count of SpaceMissions broken down by Launch Site and Company vs. Mission Status. Color shows count of SpaceMissions. The marks are labeled by count of SpaceMissions.

Dashboard:


Space Missions
Launch Site Temperature
Vandenberg 58.00
AlcÃ¢ntara Launch Center 83.67
Marshall Islands 87.00
Cape Canaveral 73.26
Kennedy Space Center 75.21
Guiana Space Centre 75.00
Launch Site Humidity
Kennedy Space Center
Marshall Islands
AlcÃ¢ntara Launch Center 84.33
Cape Canaveral 76.00
Vandenberg 74.03
Guiana Space Centre 94.00
Launch Site Wind Speed
Launch Site
Wind Speed
AlcÃ¢ntara Launch Ce..
Cape Canaveral
Guiana Space..
Kennedy Space ..
Marshall Islands
Vandenberg
Launch Site
Avg. Tempe..
452.14
Company
Count of Sp..
1
52
Satellite Details
Company
Vehicle Type
Arianespace
Ariane 5 ECA
Ariane 5 G
Ariane 42P
Vega
Boeing
Delta II 7320-10C
Delta II 7326
Delta II 7420-10C
Delta II 7425
Delta II 7425-10C
Delta II 7426
Mission Status
Company / Mission Status
Count of Payload to Orbit (kg)
Failure
Success
Track Records
Launch Site / Company
Guiana Space Centre
Cape Canaveral
Mission Status
Failure
Success

Fetching Details: