

Satoshi Ido  
34788706  
Professor. Keaton  
16 December, 2023

STAT 506

# Final Project

## Description of your project and data

- The COVID-19 Dataset, which is from Kaggle, contains a number of Confirmed, Death and Recovered cases every day across the globe.
- From the data source, these two datasets were used:
  - country\_wise\_latest
  - covid\_19\_clean\_complete
- Due to the specific limitations regarding column names in SAS, some columns have been replaced by slightly different column names
- Variables:
  - country\_wise\_latest
    - Country\_Region, Confirmed, Deaths, Recovered, Active, New\_cases, New\_deaths, New\_recovered, Deaths\_100\_Cases, Recovered\_100\_Cases, Deaths\_100\_Recovered, Confirmed\_last\_week, one\_week\_change, one\_week\_increase\_rate, WHO\_Region
  - covid\_19\_clean\_complete
    - Province\_State, Country\_Region, Lat, Long, Date, Confirmed, Deaths, Recovered, Active, WHO\_Region
- Data sets link: <https://tinyurl.com/ys52zfsy>
- The chosen topics: 1, 3, 5, 6, 8, 14, 15, 20, 24, 25

# Topics from PG1

1)

Code:

```
/* Accessing Data (PG1.02) */
/* 1 */
/* 1a */
proc import datafile='/home/u62387331/STAT506/final project/country_wise_latest.csv'
  dbms=csv
  out=final.country_wise_latest;
run;

proc import datafile='/home/u62387331/STAT506/final project/covid_19_clean_complete.csv'
  dbms=csv
  out=final.covid_19_complete;
run;
/* 1b */
proc contents varnum data=final.country_wise_latest; run;
proc contents varnum data=final.covid_19_complete; run;
```

Outputs:

```
1      OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
68
69      proc import datafile='/home/u62387331/STAT506/final project/country_wise_latest.csv'
70      dbms=csv
71      out=final.country_wise_latest;
72      run;

NOTE: Import cancelled. Output dataset FINAL.COUNTRY_WISE_LATEST already exists. Specify REPLACE option to overwrite it.
NOTE: The SAS System stopped processing this step because of errors.
NOTE: PROCEDURE IMPORT used (Total process time):
      real time          0.00 seconds
      user cpu time      0.00 seconds
      system cpu time    0.00 seconds
      memory             193.78k
      OS Memory          21664.00k
      Timestamp          12/11/2023 06:39:08 PM
      Step Count         66  Switch Count  0
      Page Faults        0
      Page Reclaims      18
      Page Swaps         0
      Voluntary Context Switches  3
      Involuntary Context Switches 0
      Block Input Operations 0
      Block Output Operations 0

73

74      proc import datafile='/home/u62387331/STAT506/final project/covid_19_clean_complete.csv'
75      dbms=csv
76      out=final.covid_19_complete;
77      run;

NOTE: Import cancelled. Output dataset FINAL.COVID_19_COMPLETE already exists. Specify REPLACE option to overwrite it.
NOTE: The SAS System stopped processing this step because of errors.
NOTE: PROCEDURE IMPORT used (Total process time):
      real time          0.00 seconds
      user cpu time      0.00 seconds
      system cpu time    0.00 seconds
      memory             193.25k
      OS Memory          21664.00k
      Timestamp          12/11/2023 06:39:08 PM
      Step Count         67  Switch Count  0
      Page Faults        0
      Page Reclaims      14
      Page Swaps         0
      Voluntary Context Switches  1
      Involuntary Context Switches 0
      Block Input Operations 0
      Block Output Operations 0

78
```

The CONTENTS Procedure				
Data Set Name	FINAL_COUNTRY_WISE_LATEST			Observations
Member Type	DATA			Variables
Engine	BASE			Indexes
Created	12/06/2023 17:15:24			Observation Length
Last Modified	12/06/2023 17:15:24			Deleted Observations
Protection				Compressed
Data Set Type				Sorted
Label				
Data Representation	SOLARIS_X86_64, LINUX_X86_64, ALPHA_TRU64, LINUX_IA64			
Encoding	utf-8 Unicode (UTF-8)			

  

Engine/Host Dependent Information	
Data Set Page Size	131072
Number of Data Set Pages	1
First Data Page	1
Max Obs per Page	909
Obs in First Data Page	187
Number of Data Set Repairs	0
Filename	/home/u62387331/STAT506/final project/country_wise_latest.sas7dat
Release Created	9.0401M7
Host Created	Linux
Inode Number	17311964131
Access Permission	rw-r--r--
Owner Name	u62387331
File Size	256KB
File Size (bytes)	262144

  

Variables in Creation Order					
#	Variable	Type	Len	Format	Informat
1	Country_Region	Char	19	\$19.	\$19.
2	Confirmed	Num	8	BEST12.	BEST32.
3	Deaths	Num	8	BEST12.	BEST32.
4	Recovered	Num	8	BEST12.	BEST32.
5	Active	Num	8	BEST12.	BEST32.
6	New_cases	Num	8	BEST12.	BEST32.
7	New_deaths	Num	8	BEST12.	BEST32.
8	New_recovered	Num	8	BEST12.	BEST32.
9	Deaths_100_Cases	Num	8	BEST12.	BEST32.
10	Recovered_100_Cases	Num	8	BEST12.	BEST32.
11	Deaths_100_Recovered	Num	8	BEST12.	BEST32.
12	Confirmed_last_week	Num	8	BEST12.	BEST32.
13	one_week_change	Num	8	BEST12.	BEST32.
14	one_week_increase_rate	Num	8	BEST12.	BEST32.
15	WHO_Region	Char	21	\$21.	\$21.

  

Sort Information	
Sortedby	Country_Region
Validated	YES
Character Set	ASCII

The CONTENTS Procedure				
Data Set Name	FINAL_COVID_19_COMPLETE			Observations
Member Type	DATA			Variables
Engine	BASE			Indexes
Created	12/04/2023 15:33:34			Observation Length
Last Modified	12/04/2023 15:33:34			Deleted Observations
Protection				Compressed
Data Set Type				Sorted
Label				
Data Representation	SOLARIS_X86_64, LINUX_X86_64, ALPHA_TRU64, LINUX_IA64			
Encoding	utf-8 Unicode (UTF-8)			

  

Engine/Host Dependent Information	
Data Set Page Size	131072
Number of Data Set Pages	49
First Data Page	1
Max Obs per Page	1022
Obs in First Data Page	998
Number of Data Set Repairs	0
Filename	/home/u62387331/STAT506/final project/covid_19_complete.sas7dat
Release Created	9.0401M7
Host Created	Linux
Inode Number	17311240860
Access Permission	rw-r--r--
Owner Name	u62387331
File Size	6MB
File Size (bytes)	6553600

  

Variables in Creation Order					
#	Variable	Type	Len	Format	Informat
1	Province_State	Char	28	\$28.	\$28.
2	Country_Region	Char	19	\$19.	\$19.
3	Lat	Num	8	BEST12.	BEST32.
4	Long	Num	8	BEST12.	BEST32.
5	Date	Num	8	YYMMDD10.	YYMMDD10.
6	Confirmed	Num	8	BEST12.	BEST32.
7	Deaths	Num	8	BEST12.	BEST32.
8	Recovered	Num	8	BEST12.	BEST32.
9	Active	Num	8	BEST12.	BEST32.
10	WHO_Region	Char	21	\$21.	\$21.

Code:

```
/* Exploring and Validating Data (PG1.03) */
/* 3 */
proc print data=final.covid_19_complete(obs=10); /* 3a, 3c*/
  var Country_Region Lat Long WHO_Region; /* 3b */
  where WHO_Region IN ("Africa","Europe"); /* 3d */
  format Lat COMMA12.1; /* 3e */
  format Long COMMA12.1; /* 3e */
run;
```

Outputs:

Obs	Country_Region	Lat	Long	WHO_Region
2	Albania	41.2	20.2	Europe
3	Algeria	28.0	1.7	Africa
4	Andorra	42.5	1.5	Europe
5	Angola	-11.2	17.9	Africa
8	Armenia	40.1	45.0	Europe
17	Austria	47.5	14.6	Europe
18	Azerbaijan	40.1	47.6	Europe
23	Belarus	53.7	28.0	Europe
24	Belgium	50.8	4.5	Europe
25	Benin	9.3	2.3	Africa

5)

Code:

```
data final.topic5;
  set final.country_wise_latest; /* 5a */
  where WHO_Region IN ("Africa","Europe"); /* 5b */
  drop Recovered; /* 5c */
  format Recovered_100_Cases 12.4; /* 5d */
  length Province_State $30.; /* 5e */
  Deaths_rate=Deaths/Confirmed; /* 5f */
  if Deaths_rate<=0.05 then low_death_rate=1; /* 5f */
run;
proc print data=final.topic5(obs=10); run;
```

Outputs:

Obs	Country_Region	Confirmed	Deaths	Active	New_cases	New_deaths	New_recovered	Deaths_100_Cases	Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate	WHO_Region	Province_State	Deaths_rate	low_death_rate
1	Albania	4880	144	1991	117	6	63	2.95	56.2500	5.25	4171	709	17	Europe		0.02951	1
2	Algeria	27973	1163	7973	616	8	749	4.16	67.3400	6.17	23691	4282	18.07	Africa		0.04158	1
3	Andorra	907	52	52	10	0	0	5.73	88.5300	6.48	884	23	2.6	Europe		0.05733	.
4	Angola	950	41	687	18	1	0	4.32	25.4700	16.94	749	201	26.84	Africa		0.04316	1
5	Armenia	37390	711	10014	73	6	187	1.9	71.3200	2.67	34981	2409	6.89	Europe		0.01902	1
6	Austria	20558	713	1599	86	1	37	3.47	88.7500	3.91	19743	815	4.13	Europe		0.03468	1
7	Azerbaijan	30446	423	6781	396	6	558	1.39	76.3400	1.82	27890	2556	9.16	Europe		0.01389	1
8	Belarus	67251	538	6221	119	4	67	0.8	89.9500	0.89	66213	1038	1.57	Europe		0.00800	1
9	Belgium	66428	9822	39154	402	1	14	14.79	26.2700	56.28	64094	2334	3.64	Europe		0.14786	.
10	Benin	1770	35	699	0	0	0	1.98	58.5300	3.38	1602	168	10.49	Africa		0.01977	1

6)

Code:

```
/* 6 */
data final.topic6;
  set final.country_wise_latest;
  if Active > 10000 then high_Active_num=1; /* 6a */
  Deaths_rate=Deaths/Confirmed; /* 6b */
  if Deaths_rate <= 0.05 then low_death_rate=1; /* 6b */
  else if Deaths_rate > 0.05 then low_death_rate=0; /* 6b */
  if WHO_Region="Americas" then do; /* 6c */
    Region_America="Yes"; /* 6c */
  end;
run;
proc print data=final.topic6; run;
```

Outputs:

Active	New_cases	New_deaths	New_recovered	Deaths_100_Cases	Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate	WHO_Region	high_Active_num	Deaths_rate	low_death_rate	Region_America
9796	106	10	18	3.5	69.48	5.04	35526	737	2.07	Eastern Mediterranean	.	0.03499	1	
1991	117	6	63	2.95	56.25	5.25	4171	709	17	Europe	.	0.02951	1	
7973	616	8	749	4.16	67.34	6.17	23691	4282	18.07	Africa	.	0.04158	1	
52	10	0	0	5.73	88.53	6.48	884	23	2.6	Europe	.	0.05733	0	
667	18	1	0	4.32	25.47	16.94	749	201	26.84	Africa	.	0.04316	1	
18	4	0	5	3.49	75.58	4.62	76	10	13.16	Americas	.	0.03488	1	Yes
91782	4890	120	2057	1.83	43.35	4.21	130774	36642	28.02	Americas	1	0.01827	1	Yes
10014	73	6	187	1.9	71.32	2.67	34981	2409	6.89	Europe	1	0.01902	1	
5825	368	6	137	1.09	60.84	1.79	12428	2875	23.13	Western Pacific	.	0.01091	1	
1599	86	1	37	3.47	88.75	3.91	19743	815	4.13	Europe	.	0.03468	1	
6781	396	6	558	1.39	76.34	1.82	27890	2556	9.16	Europe	.	0.01389	1	
280	40	0	0	2.88	23.82	12.09	174	208	119.54	Americas	.	0.02880	1	Yes
3231	351	1	421	0.36	91.46	0.39	36936	2546	6.89	Eastern Mediterranean	.	0.00357	1	
97577	2772	37	1801	1.31	55.56	2.36	207453	18772	9.05	South-East Asia	1	0.01311	1	
9	0	0	0	6.36	85.45	7.45	106	4	3.77	Americas	.	0.06364	0	Yes
6221	119	4	67	0.8	89.95	0.89	66213	1038	1.57	Europe	.	0.00800	1	
39154	402	1	14	14.79	26.27	56.28	64094	2334	3.64	Europe	1	0.14786	0	
20	0	0	0	4.17	54.17	7.69	40	8	20	Americas	.	0.04167	1	Yes
699	0	0	0	1.98	58.53	3.38	1602	168	10.49	Africa	.	0.01977	1	
13	4	0	1	0	86.87	0	90	9	10	South-East Asia	.	0.00000	1	
47056	1752	64	309	3.72	30.17	12.32	60991	10190	16.71	Americas	1	0.03719	1	Yes
5274	731	14	375	2.8	46.96	5.96	8479	2019	23.81	Europe	.	0.02801	1	
674	53	1	11	0.27	8.53	3.17	522	217	41.57	Africa	.	0.00271	1	
508116	23284	614	33728	3.59	75.61	4.74	2118646	323729	15.28	Americas	1	0.03587	1	Yes

8)

Code:

```

/* Analyzing and Reporting on Data (PG1.05) */
/* 8 */
data final.topic8; /* data modification */
  set final.country_wise_latest;
  if WHO_Region="Americas" then Group=1;
  else if WHO_Region="South-East Asia" then Group=2;
  else if WHO_Region="Africa" then Group=3;
  else if WHO_Region="Europe" then Group=4;
  else if WHO_Region="Eastern Mediterranean" then Group=5;
  else Group=6;
  length Rates $11;
  if one_week_increase_rate>=50 then Rates="High rate";
  else if one_week_increase_rate<50 and one_week_increase_rate>=10 then Rates="Medium rate";
  else if one_week_increase_rate<10 then Rates="Low rate";
run;
/* 8a */
proc freq data=final.topic8 order=freq;
  tables Group;
run;
/* 8b */
proc freq data=final.topic8;
  tables rates*Group / norow nocol;
run;

```

Outputs:

The FREQ Procedure

Group	Frequency	Percent	Cumulative Frequency	Cumulative Percent
4	56	29.95	56	29.95
3	48	25.67	104	55.61
1	35	18.72	139	74.33
5	22	11.76	161	86.10
6	16	8.56	177	94.65
2	10	5.35	187	100.00

The FREQ Procedure

Frequency Percent	Table of Rates by Group						
	Group						Total
	Rates	1	2	3	4	5	
High rate	1	0	2	0	0	1	4
	0.53	0.00	1.07	0.00	0.00	0.53	2.14
Low rate	15	6	23	39	15	10	108
	8.02	3.21	12.30	20.86	8.02	5.35	57.75
Medium rate	19	4	23	17	7	5	75
	10.16	2.14	12.30	9.09	3.74	2.67	40.11
Total	35	10	48	56	22	16	187
	18.72	5.35	25.67	29.95	11.76	8.56	100.00

## Topics from PG2

14)

Code:

```
/* Controlling DATA Step Processing (PG2.01) */
/* 14 */
data Americas(drop=Rates) Europe(drop=Rates) other(drop=Rates); /* 14b */
  set final.topic8;
  select(WHO_Region);
    when ("Americas") do;
      output Americas; /* 14a(2) */
      putlog Country_Region=; /* 14c */
    end;
    when ("Europe") do;
      output Europe; /* 14a(2) */
      putlog Country_Region=; /* 14c */
    end;
    otherwise output other; /* 14a(1), (2) */
  end;
run;

proc print data=Americas; run;
proc print data=Europe; run;
proc print data=other; run;
```

Outputs:

```
Country_Region=US
Country_Region=Ukraine
Country_Region=United Kingdom
Country_Region=Uruguay
Country_Region=Uzbekistan
Country_Region=Venezuela
NOTE: There were 187 observations read from the data set FINAL.TOPIC8.
NOTE: The data set WORK.AMERICAS has 35 observations and 16 variables.
NOTE: The data set WORK.EUROPE has 56 observations and 16 variables.
NOTE: The data set WORK.OTHER has 96 observations and 16 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      user cpu time       0.01 seconds
      system cpu time     0.00 seconds
      memory              1606.53k
      OS Memory           23216.00k
      Timestamp           12/11/2023 07:32:23 PM
      Step Count           132      Switch Count   6
      Page Faults          0
      Page Reclaims        404
      Page Swaps           0
      Voluntary Context Switches 40
      Involuntary Context Switches 0
      Block Input Operations 0
      Block Output Operations 800
```

Obs	Country_Region	Confirmed	Deaths	Recovered	Active	New_cases	New_deaths	New_recovered	Deaths_100_Cases	Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate	WHO_Region	Group
1	Antigua and Barbuda	86	3	65	18	4	0	5	3.49	75.58	4.62	76	10	13.16	Americas	1
2	Argentina	167416	3059	72575	91782	4890	120	2057	1.83	43.35	4.21	130774	36642	28.02	Americas	1
3	Bahamas	382	11	91	280	40	0	0	2.88	23.82	12.09	174	208	119.54	Americas	1
4	Barbados	110	7	94	9	0	0	0	6.36	85.45	7.45	106	4	3.77	Americas	1
5	Belize	48	2	26	20	0	0	0	4.17	54.17	7.69	40	8	20	Americas	1
6	Bolivia	71181	2647	21478	47056	1752	64	309	3.72	30.17	12.32	60991	10190	16.71	Americas	1
7	Brazil	2442375	87618	1846641	508116	23284	614	33728	3.59	75.61	4.74	2118646	323729	15.28	Americas	1
8	Canada	116458	8944	0	107514	682	11	0	7.88	0	0	112925	3533	3.13	Americas	1
9	Chile	347923	9187	319954	18782	2133	75	1859	2.64	91.96	2.87	333029	14894	4.47	Americas	1
10	Colombia	257101	8777	131161	117163	16306	508	11494	3.41	51.02	6.69	204005	53096	26.03	Americas	1
11	Costa Rica	15841	115	3824	11902	612	11	88	0.73	24.14	3.01	11534	4307	37.34	Americas	1
12	Cuba	2532	87	2351	94	37	0	2	3.44	92.85	3.7	2446	86	3.52	Americas	1

Obs	Country_Region	Confirmed	Deaths	Recovered	Active	New_cases	New_deaths	New_recovered	Deaths_100_Cases	Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate	WHO_Region	Group
1	Albania	4880	144	2745	1991	117	6	63	2.95	56.25	5.25	4171	709	17	Europe	4
2	Andorra	907	52	803	52	10	0	0	5.73	88.53	6.48	884	23	2.6	Europe	4
3	Armenia	37390	711	26665	10014	73	6	187	1.9	71.32	2.67	34981	2409	6.89	Europe	4
4	Austria	20558	713	18346	1599	86	1	37	3.47	88.75	3.91	19743	815	4.13	Europe	4
5	Azerbaijan	30446	423	23242	6781	396	6	558	1.39	76.34	1.82	27890	2556	9.16	Europe	4
6	Belarus	67251	538	60492	6221	119	4	67	0.8	89.95	0.89	66213	1038	1.57	Europe	4
7	Belgium	66428	9622	17452	39154	402	1	14	14.79	26.27	56.28	64094	2334	3.64	Europe	4
8	Bosnia and Herzegov	10498	294	4930	5274	731	14	375	2.8	46.96	5.96	8479	2019	23.81	Europe	4
9	Bulgaria	10621	347	5585	4689	194	7	230	3.27	52.58	6.21	8929	1692	18.95	Europe	4
10	Croatia	4881	139	3936	806	24	3	70	2.85	80.64	3.53	4370	511	11.69	Europe	4
11	Cyprus	1060	19	852	189	3	0	0	1.79	80.38	2.23	1038	22	2.12	Europe	4
12	Czechia	15516	373	11428	3715	192	2	0	2.4	73.65	3.26	14098	1418	10.06	Europe	4
13	Denmark	13761	613	12605	543	109	0	77	4.45	91.6	4.86	13453	308	2.29	Europe	4
14	Estonia	2034	69	1923	42	0	0	1	3.39	94.54	3.59	2021	13	0.64	Europe	4
15	Finland	7398	329	6920	149	5	0	0	4.45	93.54	4.75	7340	58	0.79	Europe	4
16	France	220352	30212	81212	108928	2551	17	267	13.71	36.86	37.2	214023	6329	2.96	Europe	4
17	Georgia	1137	16	922	199	6	0	2	1.41	81.09	1.74	1039	98	9.43	Europe	4
18	Germany	207112	9125	190314	7673	445	1	259	4.41	91.89	4.79	203325	3787	1.86	Europe	4
19	Greece	4227	202	1374	2651	34	0	0	4.78	32.51	14.7	4012	215	5.36	Europe	4

Obs	Country_Region	Confirmed	Deaths	Recovered	Active	New_cases	New_deaths	New_recovered	Deaths_100_Cases	Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate	WHO_Region	Group
1	Afghanistan	36263	1269	25198	9796	106	10	18	3.5	69.49	5.04	35526	737	2.07	Eastern Mediterranean	5
2	Algeria	27973	1163	18837	7973	616	8	749	4.16	67.34	6.17	23691	4282	18.07	Africa	3
3	Angola	950	41	242	667	18	1	0	4.32	25.47	16.94	749	201	26.84	Africa	3
4	Australia	15303	167	9311	5825	368	6	137	1.09	60.84	1.79	12428	2875	23.13	Western Pacific	6
5	Bahrain	39482	141	36110	3231	351	1	421	0.36	91.46	0.39	36936	2546	6.89	Eastern Mediterranean	5
6	Bangladesh	226225	2965	125683	97577	2772	37	1801	1.31	55.56	2.36	207453	18772	9.05	South-East Asia	2
7	Benin	1770	35	1036	699	0	0	0	1.98	58.53	3.38	1602	168	10.49	Africa	3
8	Bhutan	99	0	86	13	4	0	1	0	86.87	0	90	9	10	South-East Asia	2
9	Botswana	739	2	63	674	53	1	11	0.27	8.53	3.17	522	217	41.57	Africa	3
10	Brunei	141	3	138	0	0	0	0	2.13	97.87	2.17	141	0	0	Western Pacific	6
11	Burkina Faso	1100	53	926	121	14	0	6	4.82	84.18	5.72	1065	35	3.29	Africa	3
12	Burma	350	6	292	52	0	0	2	1.71	83.43	2.05	341	9	2.64	South-East Asia	2
13	Burundi	378	1	301	76	17	0	22	0.26	79.63	0.33	322	56	17.39	Africa	3
14	Cabo Verde	2328	22	1550	756	21	0	103	0.95	66.58	1.42	2071	257	12.41	Africa	3
15	Cambodia	226	0	147	79	1	0	4	0	65.04	0	171	55	32.16	Western Pacific	6
16	Cameroon	17110	391	14539	2180	402	6	0	2.29	84.97	2.69	16157	953	5.9	Africa	3
17	Central African Rep	4599	59	1546	2994	0	0	0	1.28	33.62	3.82	4548	51	1.12	Africa	3
18	Chad	922	75	810	37	7	0	0	8.13	87.85	9.26	889	33	3.71	Africa	3

15)

Code:



```

/* Summarizing Data (PG2.02) */
/* 15 */
proc sort data=final.topic8 out=final.sort_topic8; /* 15d */
    by WHO_Region;
run;
proc print data=final.sort_topic8; run;

data final.topic15(keep=WHO_Region Sumdeath);
    set final.sort_topic8;
    by WHO_Region; /* 15c */
    if first.WHO_Region=1 then Sumdeath=0;
    retain Sumdeath 0; /* 15a */
    Sumdeath=sum(Sumdeath, Deaths); /* 15b */
    if last.WHO_Region=1; /* 15c */
    output;
run;

proc print data=final.topic15; run;

```

Outputs:

Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate	WHO_Region	Group	Rates
67.34	6.17	23691	4282	18.07	Africa	3	Medium rate
25.47	16.94	749	201	26.84	Africa	3	Medium rate
58.53	3.38	1602	168	10.49	Africa	3	Medium rate
8.53	3.17	522	217	41.57	Africa	3	Medium rate
84.18	5.72	1065	35	3.29	Africa	3	Low rate
79.63	0.33	322	56	17.39	Africa	3	Medium rate
66.58	1.42	2071	257	12.41	Africa	3	Medium rate
84.97	2.69	16157	953	5.9	Africa	3	Low rate
33.62	3.82	4548	51	1.12	Africa	3	Low rate
87.85	9.26	889	33	3.71	Africa	3	Low rate
92.66	2.13	334	20	5.99	Africa	3	Low rate
25.91	6.51	2851	349	12.24	Africa	3	Medium rate
64.45	3.65	8443	401	4.75	Africa	3	Low rate
66.18	0.93	14312	1343	9.38	Africa	3	Low rate
27.42	6.06	3071	0	0	Africa	3	Low rate
72.08	0	251	14	5.58	Africa	3	Low rate
44.26	3.32	1826	490	26.83	Africa	3	Medium rate

Obs	WHO_Region	Sumdeath
1	Africa	12223
2	Americas	342732
3	Eastern Mediterranean	38339
4	Europe	211144
5	South-East Asia	41349
6	Western Pacific	8249

Code:

```
/* Manipulating Data with Functions (PG2.03) */
/* 20 */
data final.topic20;
  set final.country_wise_latest;
  round_Recovered_100_Cases = round(Recovered_100_Cases, 0.1); /* 20a */
  ceil_Recovered_100_Cases = ceil(Recovered_100_Cases); /* 20a */
  floor_Recovered_100_Cases = floor(Recovered_100_Cases); /* 20a */
  int_Recovered_100_Cases = int(Recovered_100_Cases); /* 20a */
  largest_num = largest(1, Deaths_100_cases, Recovered_100_cases, Deaths_100_recovered); /* 20b */
  max_num = max(Deaths_100_cases, Recovered_100_cases, Deaths_100_recovered); /* 20b */
  sum_num = sum(Deaths_100_cases, Recovered_100_cases, Deaths_100_recovered); /* 20b */
  Num_Non_Missing = N(Deaths_100_cases, Recovered_100_cases, Deaths_100_recovered); /* 20c */
run;
proc print data=final.topic20;
run;
```

Outputs:

Obs	Country_Region	Confirmed	Deaths	Recovered	Active	New_cases	New_deaths	New_recovered	Deaths_100_Cases	Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate	WHO_Region
1	Afghanistan	36263	1269	25198	9796	106	10	18	3.5	69.49	5.04	35526	737	2.07	Eastern Mediterranean
2	Albania	4880	144	2745	1991	117	6	63	2.95	56.25	5.25	4171	709	17	Europe
3	Algeria	27973	1163	18837	7973	616	8	749	4.16	67.34	6.17	23691	4282	18.07	Africa
4	Andorra	907	52	803	52	10	0	0	5.73	88.53	6.48	884	23	2.6	Europe
5	Angola	950	41	242	667	18	1	0	4.32	25.47	16.94	749	201	26.84	Africa
6	Antigua and Barbuda	86	3	65	18	4	0	5	3.49	75.58	4.62	76	10	13.16	Americas
7	Argentina	167416	3059	72575	91782	4890	120	2057	1.83	43.35	4.21	130774	36642	28.02	Americas
8	Armenia	37390	711	26665	10014	73	6	187	1.9	71.32	2.67	34981	2409	6.89	Europe
9	Australia	15303	167	9311	5825	368	6	137	1.09	60.84	1.79	12428	2875	23.13	Western Pacific
10	Austria	20558	713	16246	1599	86	1	37	3.47	88.75	3.91	19743	815	4.13	Europe

WHO_Region	round_Recovered_100_Cases	ceil_Recovered_100_Cases	floor_Recovered_100_Cases	int_Recovered_100_Cases	largest_num	max_num	sum_num	Num_Non_Missing
Eastern Mediterranean	69.5	70	69	69	69.49	69.49	78.03	3
Europe	56.3	57	56	56	56.25	56.25	64.45	3
Africa	67.3	68	67	67	67.34	67.34	77.67	3
Europe	88.5	89	88	88	88.53	88.53	100.74	3
Africa	25.5	26	25	25	25.47	25.47	46.73	3
Americas	75.6	76	75	75	75.58	75.58	83.69	3
Americas	43.4	44	43	43	43.35	43.35	49.39	3
Europe	71.3	72	71	71	71.32	71.32	75.89	3
Western Pacific	60.8	61	60	60	60.84	60.84	63.72	3
Europe	88.8	89	88	88	88.75	88.75	96.13	3

24)

Code:

```
data final.topic24; /* 24b */
  merge final.covid_19_singlevalue(
    RENAME=(Lat=Latitude Long=Longitude)
    drop=Province_State Date Confirmed Deaths Recovered Active)
    final.country_wise_latest; /* 24a */
  by Country_Region;
run;
proc print data=final.topic24; run;
```

Outputs:

Obs	Country_Region	Latitude	Longitude	WHO_Region	Confirmed	Deaths	Recovered	Active	New_cases	New_deaths	New_recovered
1	Afghanistan	33.93911	67.709953	Eastern Mediterranean	36263	1269	25198	9796	106	10	18
2	Albania	41.1533	20.1683	Europe	4880	144	2745	1991	117	6	63
3	Algeria	28.0339	1.6596	Africa	27973	1163	18837	7973	616	8	749
4	Andorra	42.5063	1.5218	Europe	907	52	803	52	10	0	0
5	Angola	-11.2027	17.8739	Africa	950	41	242	667	18	1	0
6	Antigua and Barbuda	17.0608	-61.7964	Americas	86	3	65	18	4	0	5
7	Argentina	-38.4161	-63.6167	Americas	167416	3059	72575	91782	4890	120	2057
8	Armenia	40.0691	45.0382	Europe	37390	711	26665	10014	73	6	187
9	Australia	-35.4735	149.0124	Western Pacific	15303	167	9311	5825	368	6	137
10	Austria	47.5162	14.5501	Europe	20558	713	18246	1599	86	1	37
11	Azerbaijan	40.1431	47.5769	Europe	30446	423	23242	6781	396	6	558
12	Bahamas	25.025885	-78.035889	Americas	382	11	91	280	40	0	0

New_recovered	Deaths_100_Cases	Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate
18	3.5	69.49	5.04	35526	737	2.07
63	2.95	56.25	5.25	4171	709	17
749	4.16	67.34	6.17	23691	4282	18.07
0	5.73	88.53	6.48	884	23	2.6
0	4.32	25.47	16.94	749	201	26.84
5	3.49	75.58	4.62	76	10	13.16
2057	1.83	43.35	4.21	130774	36642	28.02
187	1.9	71.32	2.67	34981	2409	6.89
137	1.09	60.84	1.79	12428	2875	23.13
37	3.47	88.75	3.91	19743	815	4.13
558	1.39	76.34	1.82	27890	2556	9.16
0	2.88	23.82	12.09	174	208	119.54

25)

Code:

```
data final.covid_19_missing_Americas; /* data modification */
  set final.covid_19_complete;
  if WHO_Region ne 'Americas' then output;
run;
proc sort data=final.covid_19_missing_Americas out=final.covid_19_missing_Americas;
  by Country_Region;
run;

data final.matches final.non_matches;
  merge final.covid_19_missing_Americas(IN=a) final.country_wise_latest(IN=b DROP=Confirmed Deaths Recovered Active); /* 25a-(1) */
  by Country_Region;
  if a=0 and b=1 then output final.non_matches; /* 25a-(2) */
  else if a=1 and b=0 then output final.matches; /* 25a-(2) */
  else if a=1 and b=1 then output final.matches; /* 25a-(2) */
run;

data final.topic25(DROP=Province_State); /* 25b-(2) */
  merge
    final.covid_19_missing_Americas(RENAME=(Country_Region=Country))
    final.country_wise_latest(RENAME=(Country_Region=Country) DROP=Confirmed Deaths Recovered Active); /* 25b-(1), b-(2) */
  by Country;
run;

proc print data=final.matches(obs=10); run;
proc print data=final.non_matches(obs=10); run;
proc print data=final.topic25(obs=10); run;
```

Outputs:

Obs	Province_State	Country_Region	Lat	Long	Date	Confirmed	Deaths	Recovered	Active	WHO_Region	New_cases	New_deaths	New_recovered	Deaths_100_Cases	Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate
1		Afghanistan	33.93911	67.709953	2020-01-22	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
2		Afghanistan	33.93911	67.709953	2020-01-23	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
3		Afghanistan	33.93911	67.709953	2020-01-24	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
4		Afghanistan	33.93911	67.709953	2020-01-25	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
5		Afghanistan	33.93911	67.709953	2020-01-26	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
6		Afghanistan	33.93911	67.709953	2020-01-27	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
7		Afghanistan	33.93911	67.709953	2020-01-28	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
8		Afghanistan	33.93911	67.709953	2020-01-29	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
9		Afghanistan	33.93911	67.709953	2020-01-30	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
10		Afghanistan	33.93911	67.709953	2020-01-31	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07

Obs	Province_State	Country_Region	Lat	Long	Date	Confirmed	Deaths	Recovered	Active	WHO_Region	New_cases	New_deaths	New_recovered	Deaths_100_Cases	Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate
1		Antigua and Barbuda	-	-	-	-	-	-	-	Americas	4	0	5	3.49	75.58	4.62	76	10	13.16
2		Argentina	-	-	-	-	-	-	-	Americas	4890	120	2057	1.83	43.35	4.21	130774	36642	28.02
3		Bahamas	-	-	-	-	-	-	-	Americas	40	0	0	2.88	23.82	12.09	174	208	119.54
4		Barbados	-	-	-	-	-	-	-	Americas	0	0	0	6.36	85.45	7.45	106	4	3.77
5		Belize	-	-	-	-	-	-	-	Americas	0	0	0	4.17	54.17	7.69	40	8	20
6		Bolivia	-	-	-	-	-	-	-	Americas	1752	64	309	3.72	30.17	12.32	60991	10190	16.71
7		Brazil	-	-	-	-	-	-	-	Americas	23284	614	33728	3.59	75.61	4.74	2118646	323729	15.28
8		Canada	-	-	-	-	-	-	-	Americas	682	11	0	7.68	0	0	112925	3533	3.13
9		Chile	-	-	-	-	-	-	-	Americas	2133	75	1859	2.64	91.96	2.87	333029	14894	4.47
10		Colombia	-	-	-	-	-	-	-	Americas	16306	508	11494	3.41	51.02	6.69	204005	53096	26.03

Obs	Country	Lat	Long	Date	Confirmed	Deaths	Recovered	Active	WHO_Region	New_cases	New_deaths	New_recovered	Deaths_100_Cases	Recovered_100_Cases	Deaths_100_Recovered	Confirmed_last_week	one_week_change	one_week_increase_rate
1	Afghanistan	33.93911	67.709953	2020-01-22	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
2	Afghanistan	33.93911	67.709953	2020-01-23	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
3	Afghanistan	33.93911	67.709953	2020-01-24	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
4	Afghanistan	33.93911	67.709953	2020-01-25	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
5	Afghanistan	33.93911	67.709953	2020-01-26	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
6	Afghanistan	33.93911	67.709953	2020-01-27	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
7	Afghanistan	33.93911	67.709953	2020-01-28	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
8	Afghanistan	33.93911	67.709953	2020-01-29	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
9	Afghanistan	33.93911	67.709953	2020-01-30	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07
10	Afghanistan	33.93911	67.709953	2020-01-31	0	0	0	0	Eastern Mediterranean	106	10	18	3.5	69.49	5.04	35526	737	2.07