ABC Call Volume Trend Analysis

-By Sagir Mehmood

Notebook Download link:

https://colab.research.google.com/drive/1jG0Ndu_64zzjE2E8QgSxWmniS6o0H3cv?usp=sharing

Project Description:

- Trainity provided us with a dataset of a Customer Experience (CX) Inbound calling team for 23 days of ABC Insurance company. Data includes Agent_Name, Agent_ID, Queue_Time [duration for which customers have to wait before they get connected to an agent], Time [time at which a call was made by a customer in a day], Time_Bucket [for easiness we have also provided you with the time bucket], Duration [duration for which a customer and executives are on call], call status (Abandon, answered, transferred).

- A customer experience (CX) team is made up of experts who examine data and consumer input before sharing their findings with the rest of the company. The roles and responsibilities that these teams typically carry out include Customer experience programs (CX programs), Digital customer experience, Design and processes, Internal communications, Voice of the customer (VoC), User experiences, Customer experience management, Journey mapping, Nurturing customer interactions, Customer Success, Customer support, Handling Customer Data, and Learning about the Customer Journey

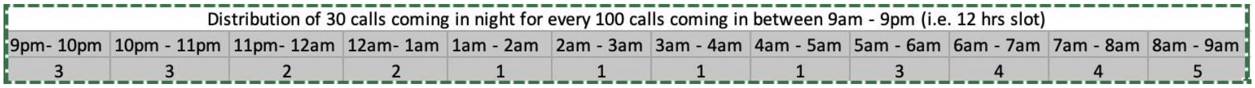
Objectives :

- A. Calculate the average call time duration for all incoming calls received by agents (in each Time_Bucket).

- B. Calculate the average call time duration for all incoming calls received by agents (in each Time_Bucket). Show the total volume/ number of calls coming in via charts/ graphs [Number of calls v/s Time]. You can select the time in a bucket form (i.e. 1-2, 2-3, …..)

- C. As you can see current abandon rate is approximately 30%. Propose a manpower plan required during each time bucket [between 9 am to 9 pm] to reduce the abandon rate to 10%. (i.e. You have to calculate the minimum number of agents required in each time bucket so that at least 90 calls should be answered out of 100.)

- D. Let’s say customers also call this ABC insurance company at night but didn’t get an answer as there are no agents to answer, this creates a bad customer experience for this Insurance company. Suppose for every 100 calls that the customer made from 9 Am to 9 Pm, a customer also made 30 calls in the night between interval [9 Pm to 9 Am] and the distribution of those 30 calls are as follows:



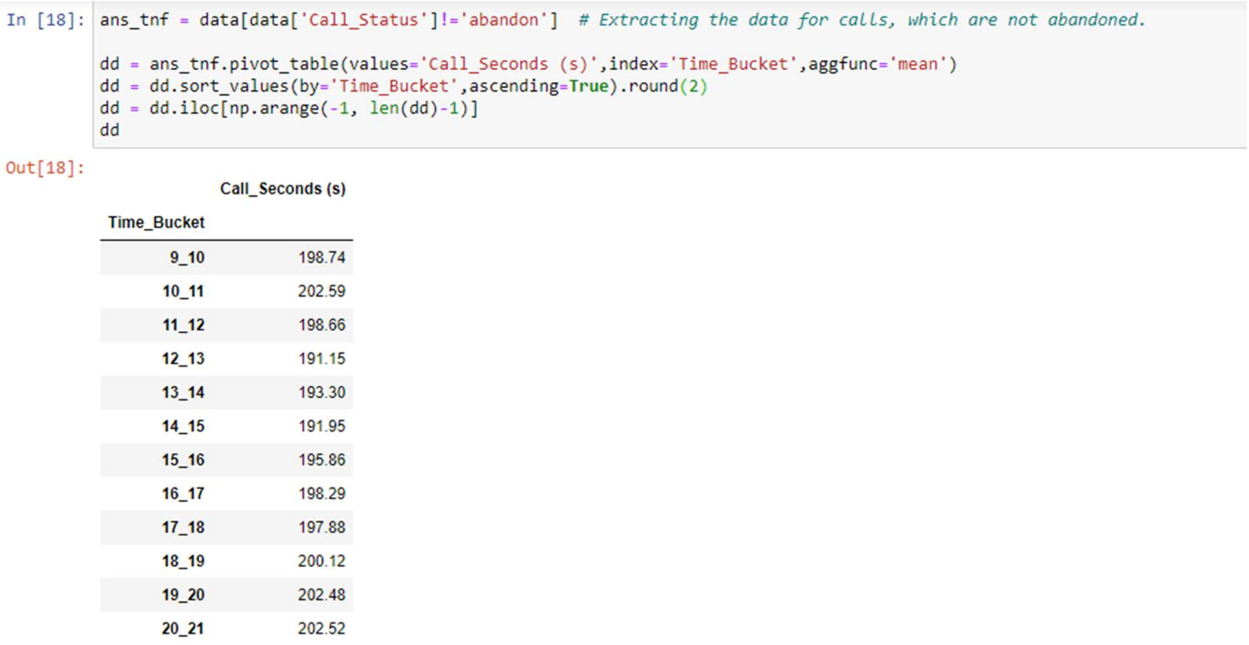
Distribution of 30 calls coming in night for every 100 calls coming in between 9am - 9pm (i.e. 12 hrs slot)											
9pm- 10pm	10pm - 11pm	11pm- 12am	12am- 1am	1am - 2am	2am - 3am	3am - 4am	4am - 5am	5am - 6am	6am - 7am	7am - 8am	8am - 9am
3	3	2	2	1	1	1	1	3	4	4	5

Now propose a manpower plan required during each time bucket in a day. The maximum Abandon rate assumption would be the same 10%.

Tech-Stack Used: Python Jyputer Notebook

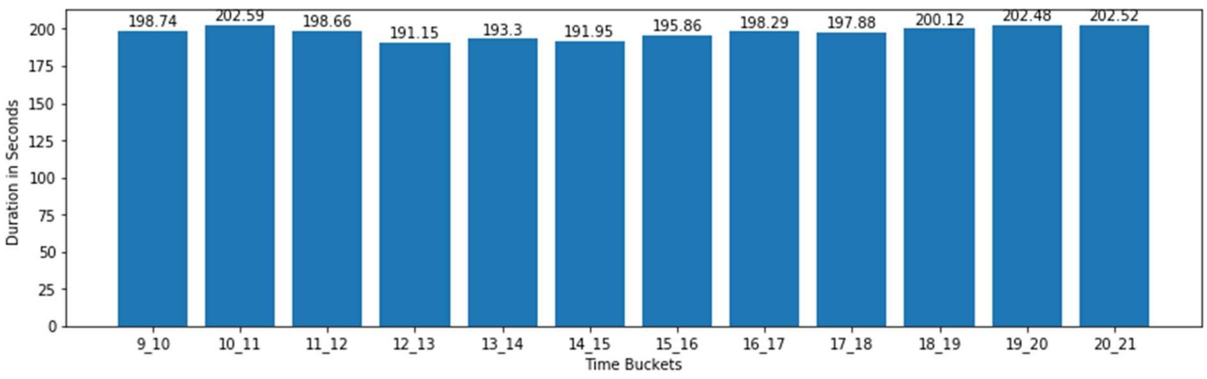
Insights & Result:

A. Calculate the average call time duration for all incoming calls received by agents (in each Time_Bucket).

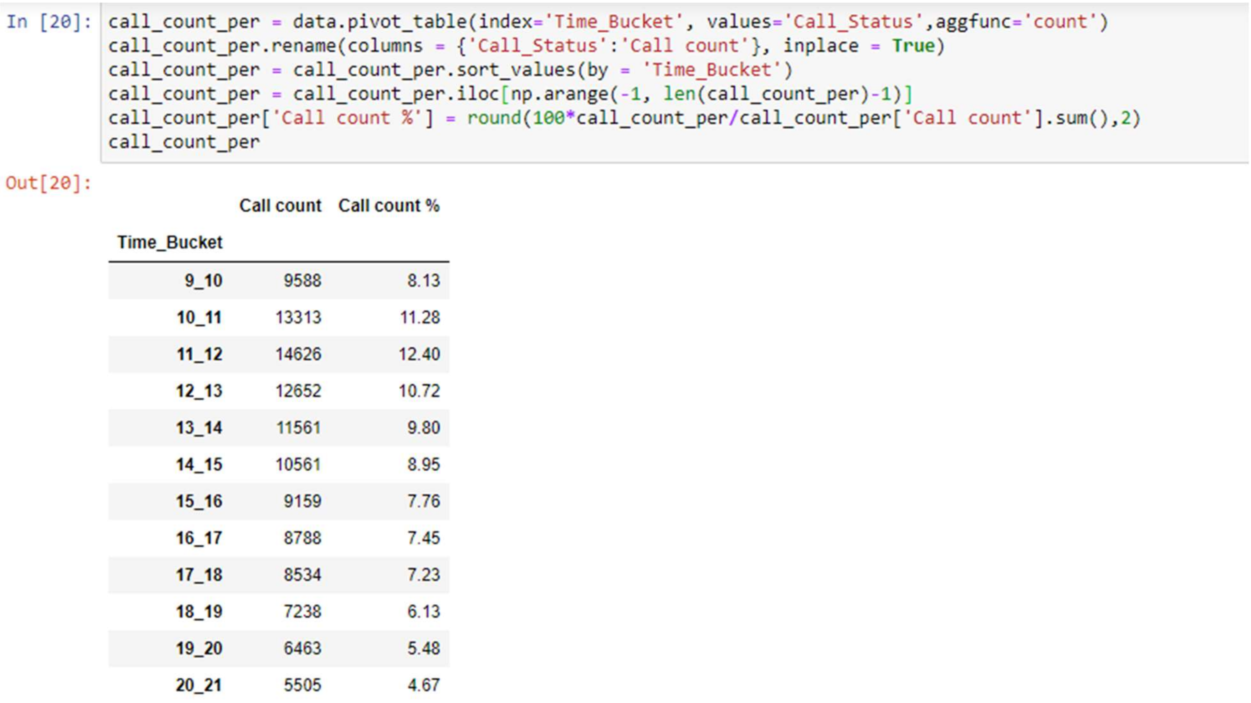


In [18]:
```
ans_tnf = data[data['Call_Status']!='abandon']  # Extracting the data for calls, which are not abandoned.

dd = ans_tnf.pivot_table(values='Call_Seconds (s)',index='Time_Bucket',aggfunc='mean')
dd = dd.sort_values(by='Time_Bucket',ascending=True).round(2)
dd = dd.iloc[np.arange(-1, len(dd)-1)]
dd
```

Out[18]:
```
              Call_Seconds (s)
Time_Bucket
       9_10             198.74
      10_11             202.59
      11_12             198.66
      12_13             191.15
      13_14             193.30
      14_15             191.95
      15_16             195.86
      16_17             198.29
      17_18             197.88
      18_19             200.12
      19_20             202.48
      20_21             202.52
```



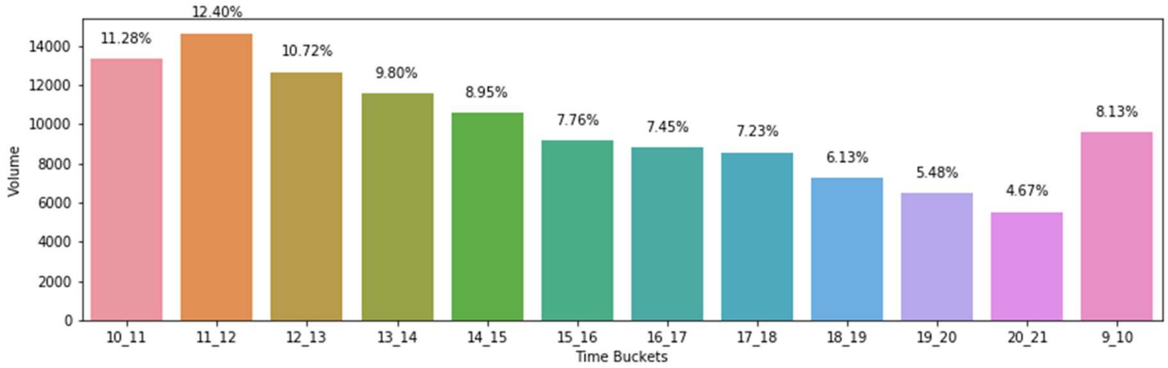
B. Show the total volume/ number of calls coming in via charts/ graphs [Number of calls v/s Time]. You can select the time in a bucket form (i.e. 1-2, 2-3, …..).



```
In [20]: call_count_per = data.pivot_table(index='Time_Bucket', values='Call_Status',aggfunc='count')
         call_count_per.rename(columns = {'Call_Status':'Call count'}, inplace = True)
         call_count_per = call_count_per.sort_values(by = 'Time_Bucket')
         call_count_per = call_count_per.iloc[np.arange(-1, len(call_count_per)-1)]
         call_count_per['Call count %'] = round(100*call_count_per/call_count_per['Call count'].sum(),2)
         call_count_per
```

Out[20]:

	Call count	Call count %
Time_Bucket		
9_10	9588	8.13
10_11	13313	11.28
11_12	14626	12.40
12_13	12652	10.72
13_14	11561	9.80
14_15	10561	8.95
15_16	9159	7.76
16_17	8788	7.45
17_18	8534	7.23
18_19	7238	6.13
19_20	6463	5.48
20_21	5505	4.67



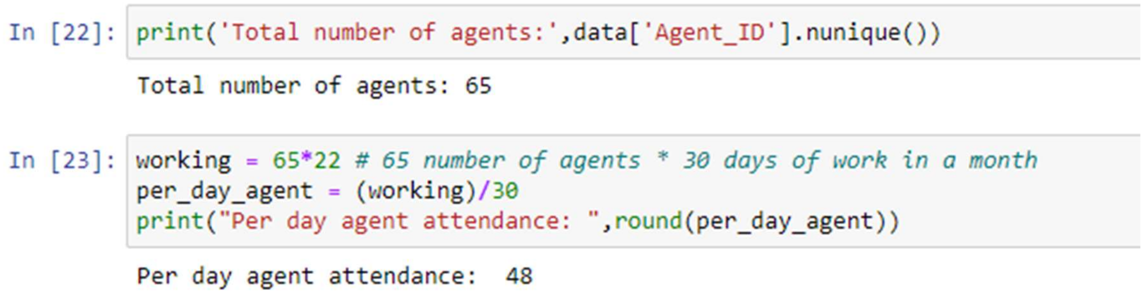
C. As you can see current abandon rate is approximately 30%. Propose a manpower plan required during each time bucket [between 9 am to 9 pm] to reduce the abandon rate to 10%. (i.e. You have to calculate the minimum number of agents required in each time bucket so that at least 90 calls should be answered out of 100.)

Assumption:

An agent work for 6 days a week; On average total unplanned leaves per agent is 4 days a month; An agent's total working hrs is 9 Hrs out of which 1.5 Hrs go into lunch and snacks in the office. On average an agent occupied 60% of his total actual working Hrs (i.e 60% of 7.5 Hrs) on the call with customers/ users. The total number of days in a month is 30 days.

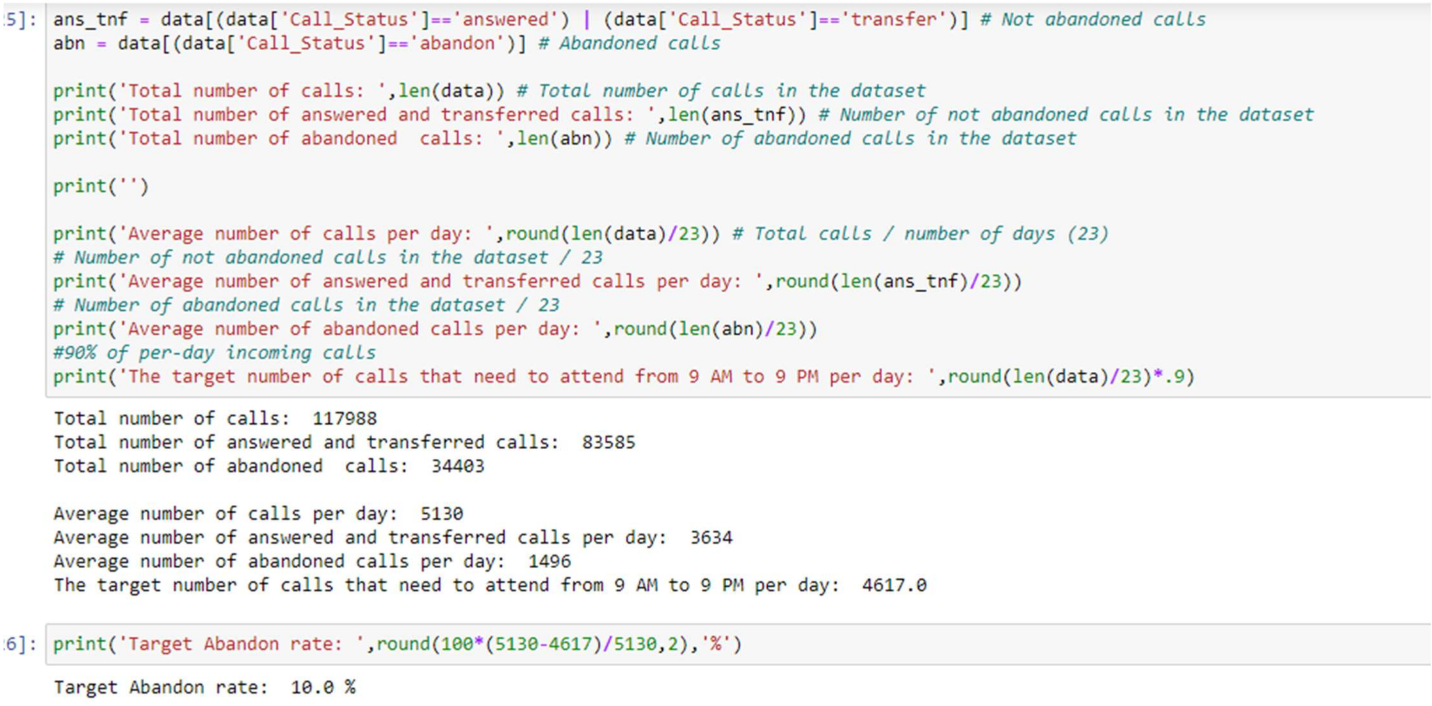
From the assumption we can say that:

- An agent works for 6 days a week, and on average total unplanned leaves per agent is 4 days a month, which means (30 - 4 - 4) = 22 days of work.
- An agent's total working hrs is 9 Hrs out of which 1.5 Hrs go into lunch and snacks in the office, On average an agent occupied 60% of his total actual working Hrs [i.e 60% of (9 - 1.5) = 7.5 Hrs] on the call with customers/ users, means 7.5 * 0.6 = 4.5 hours.



```
In [22]: print('Total number of agents:',data['Agent_ID'].nunique())

         Total number of agents: 65

In [23]: working = 65*22 # 65 number of agents * 30 days of work in a month
         per_day_agent = (working)/30
         print("Per day agent attendance: ",round(per_day_agent))

         Per day agent attendance:  48
```

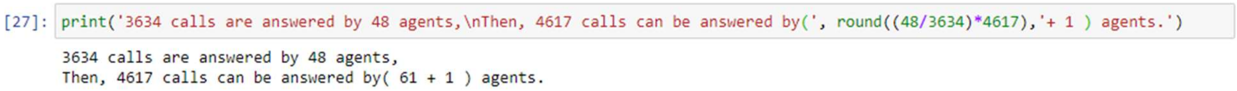
- There is a total of 65 agents are working in the company.
- From the assumptions, we get to know that an agent comes to the office 22 days per month, which means (22/30)*100 ≈ 73.5% attendance per day.
- 65 * 0.735 ≈ 48 agents come to the office per day.



```
5]: ans_tnf = data[(data['Call_Status']=='answered') | (data['Call_Status']=='transfer')] # Not abandoned calls
    abn = data[(data['Call_Status']=='abandon')] # Abandoned calls

    print('Total number of calls: ',len(data)) # Total number of calls in the dataset
    print('Total number of answered and transferred calls: ',len(ans_tnf)) # Number of not abandoned calls in the dataset
    print('Total number of abandoned  calls: ',len(abn)) # Number of abandoned calls in the dataset

    print('')

    print('Average number of calls per day: ',round(len(data)/23)) # Total calls / number of days (23)
    # Number of not abandoned calls in the dataset / 23
    print('Average number of answered and transferred calls per day: ',round(len(ans_tnf)/23))
    # Number of abandoned calls in the dataset / 23
    print('Average number of abandoned calls per day: ',round(len(abn)/23))
    #90% of per-day incoming calls
    print('The target number of calls that need to attend from 9 AM to 9 PM per day: ',round(len(data)/23)*.9)

    Total number of calls:  117988
    Total number of answered and transferred calls:  83585
    Total number of abandoned  calls:  34403

    Average number of calls per day:  5130
    Average number of answered and transferred calls per day:  3634
    Average number of abandoned calls per day:  1496
    The target number of calls that need to attend from 9 AM to 9 PM per day:  4617.0

6]: print('Target Abandon rate: ',round(100*(5130-4617)/5130,2),'%')

    Target Abandon rate:  10.0 %
```

- Total number of calls: 117988
- Total number of answered and transferred calls: 83585
- Total number of abandoned calls: 34403
- The average number of calls per day = Total number of calls / 23 = 117988/23 = 5130
- The average number of answered and transferred calls per day = Total number of answered and transferred calls / 23 = 83585/23 = 3634

- The average number of abandoned calls per day = Total number of abandoned calls/23 = 34403/23 = 1496
- The target number of calls that need to attend from 9 AM to 9 PM per day = 90% of the average number of calls per day = 5130 * 0.90 = 4617



```
[27]: print('3634 calls are answered by 48 agents,\nThen, 4617 calls can be answered by(', round((48/3634)*4617),'+ 1 ) agents.')

      3634 calls are answered by 48 agents,
      Then, 4617 calls can be answered by( 61 + 1 ) agents.
```

Unitary Method:

3634 calls are answered by 48 agents,
Then, 4617 calls can be answered by(61 + 1) agents.

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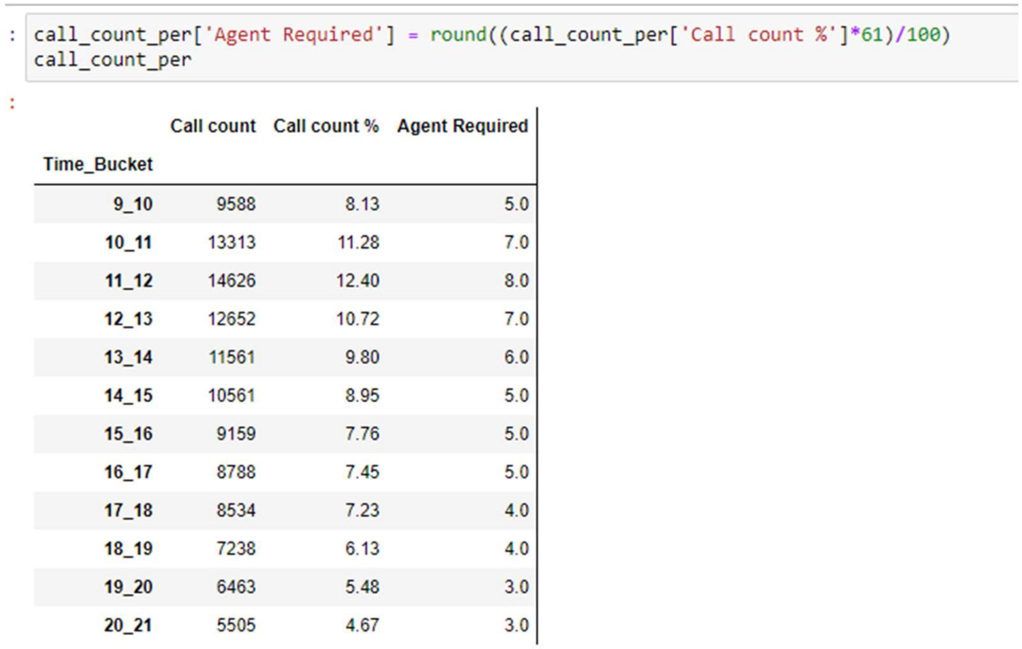
Note:

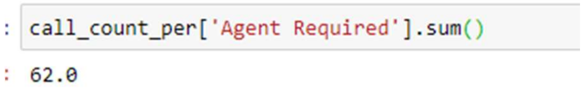
"+ 1" is given, because the answer would give a fraction value, the number of agen ts cant be a fraction, that's why first I rounded the answer, then added 1.



```
: call_count_per['Agent Required'] = round((call_count_per['Call count %']*61)/100)
  call_count_per
```

:

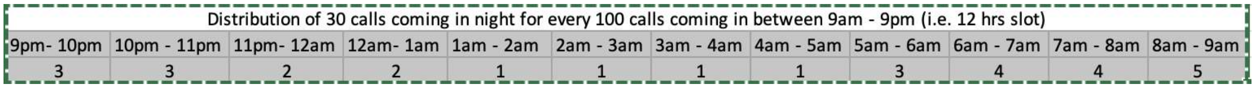
	Call count	Call count %	Agent Required
Time_Bucket			
9_10	9588	8.13	5.0
10_11	13313	11.28	7.0
11_12	14626	12.40	8.0
12_13	12652	10.72	7.0
13_14	11561	9.80	6.0
14_15	10561	8.95	5.0
15_16	9159	7.76	5.0
16_17	8788	7.45	5.0
17_18	8534	7.23	4.0
18_19	7238	6.13	4.0
19_20	6463	5.48	3.0
20_21	5505	4.67	3.0



```
: call_count_per['Agent Required'].sum()

: 62.0
```

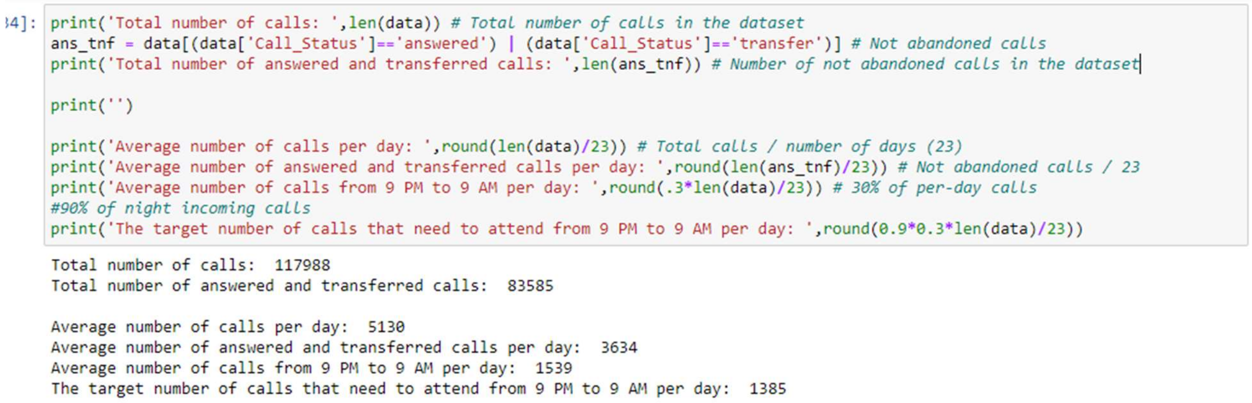
A total of 62 agents are required.

D. Let’s say customers also call this ABC insurance company at night but didn’t get an answer as there are no agents to answer, this creates a bad customer experience for this Insurance company. Suppose for every 100 calls that the customer made from 9 Am to 9 Pm, a customer also made 30 calls in the night between interval [9 Pm to 9 Am] and the distribution of those 30 calls are as follows:



Distribution of 30 calls coming in night for every 100 calls coming in between 9am - 9pm (i.e. 12 hrs slot)											
9pm- 10pm	10pm - 11pm	11pm- 12am	12am- 1am	1am - 2am	2am - 3am	3am - 4am	4am - 5am	5am - 6am	6am - 7am	7am - 8am	8am - 9am
3	3	2	2	1	1	1	1	3	4	4	5

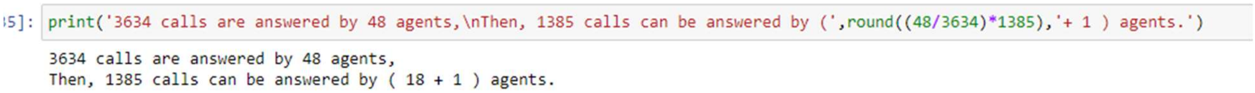
Now propose a manpower plan required during each time bucket in a day. The maximum Abandon rate assumption would be the same 10%.



```
34]: print('Total number of calls: ',len(data)) # Total number of calls in the dataset
     ans_tnf = data[(data['Call_Status']=='answered') | (data['Call_Status']=='transfer')] # Not abandoned calls
     print('Total number of answered and transferred calls: ',len(ans_tnf)) # Number of not abandoned calls in the dataset

     print('')

     print('Average number of calls per day: ',round(len(data)/23)) # Total calls / number of days (23)
     print('Average number of answered and transferred calls per day: ',round(len(ans_tnf)/23)) # Not abandoned calls / 23
     print('Average number of calls from 9 PM to 9 AM per day: ',round(.3*len(data)/23)) # 30% of per-day calls
     #90% of night incoming calls
     print('The target number of calls that need to attend from 9 PM to 9 AM per day: ',round(0.9*0.3*len(data)/23))
```

```
Total number of calls:  117988
Total number of answered and transferred calls:  83585

Average number of calls per day:  5130
Average number of answered and transferred calls per day:  3634
Average number of calls from 9 PM to 9 AM per day:  1539
The target number of calls that need to attend from 9 PM to 9 AM per day:  1385
```

- Total number of calls: 117988
- Total number of answered and transferred calls: 83585
- The average number of calls per day = Total number of calls / 23 = 117988/23 = 5130
- The average number of answered and transferred calls per day = Total number of answered and transferred calls / 23 = 83585/23 = 3634
- The average number of incoming calls per day from 9 PM to 9 AM = 30 % of per day incoming calls from 9 AM to 9 PM = 5130 * 0.30 = 1539
- The target number of calls that need to attend from 9 PM to 9 AM per day = 90% of the average   of incoming calls per day from 9 PM to 9 AM = 1539 * 0.90 = 1385



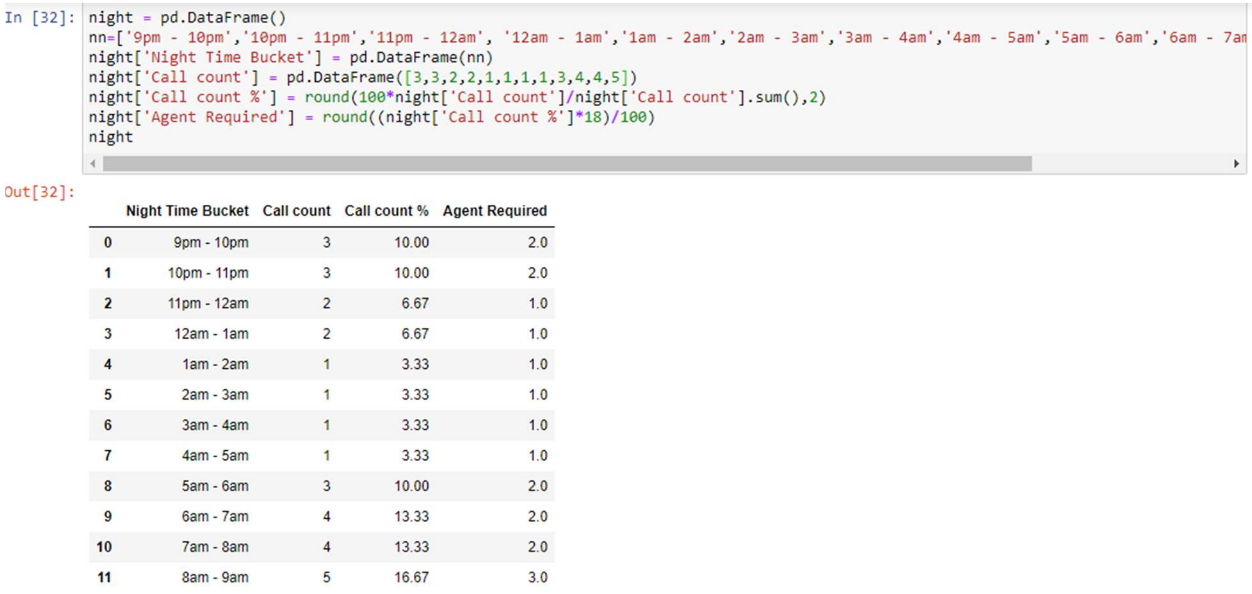
```
5]: print('3634 calls are answered by 48 agents,\nThen, 1385 calls can be answered by (',round((48/3634)*1385),'+ 1 ) agents.')

    3634 calls are answered by 48 agents,
    Then, 1385 calls can be answered by ( 18 + 1 ) agents.
```

Unitary Method:

3634 calls are answered by 48 agents,
Then, 1385 calls can be answered by(18 + 1) agents.

Note:

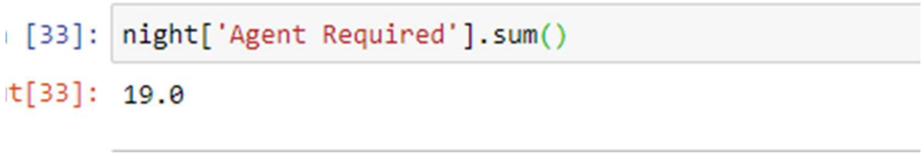
"+ 1" is given, because the answer would give a fraction value, the number of agents cant be a fraction, that's why first I rounded the answer, then added 1.



```
In [32]: night = pd.DataFrame()
         nn=['9pm - 10pm','10pm - 11pm','11pm - 12am', '12am - 1am','1am - 2am','2am - 3am','3am - 4am','4am - 5am','5am - 6am','6am - 7am
         night['Night Time Bucket'] = pd.DataFrame(nn)
         night['Call count'] = pd.DataFrame([3,3,2,2,1,1,1,1,3,4,4,5])
         night['Call count %'] = round(100*night['Call count']/night['Call count'].sum(),2)
         night['Agent Required'] = round((night['Call count %']*18)/100)
         night
```

Out[32]:

	Night Time Bucket	Call count	Call count %	Agent Required
0	9pm - 10pm	3	10.00	2.0
1	10pm - 11pm	3	10.00	2.0
2	11pm - 12am	2	6.67	1.0
3	12am - 1am	2	6.67	1.0
4	1am - 2am	1	3.33	1.0
5	2am - 3am	1	3.33	1.0
6	3am - 4am	1	3.33	1.0
7	4am - 5am	1	3.33	1.0
8	5am - 6am	3	10.00	2.0
9	6am - 7am	4	13.33	2.0
10	7am - 8am	4	13.33	2.0
11	8am - 9am	5	16.67	3.0



```
[33]: night['Agent Required'].sum()

t[33]: 19.0
```

A total of 19 agents are required during the night shift.