

Purpose

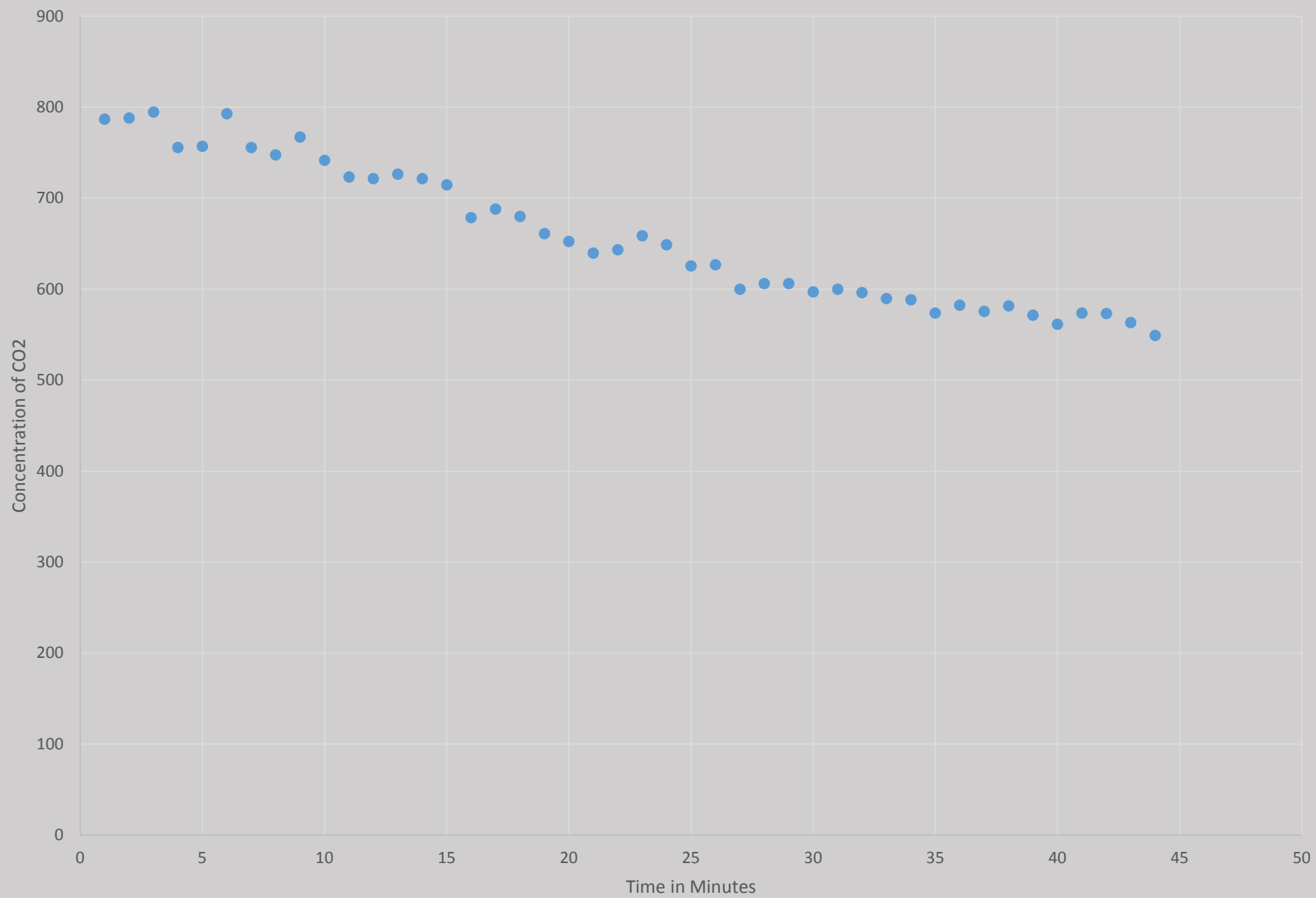
The Purpose of this lab was to use the OSHA and ASHRAE indoor air quality (IAQ) standards for CO₂ to analyze and compare recorded results of a room on Humboldt State University's Campus. The test group collected data from a library study room (room 312) with a CO₂ meter (HOBO data logger). The individuals breathed normally for a period of time until the room was filled with at least 700ppm. Once this level of CO₂ was reached group members left the room for 45 minutes with the doors and windows closed. The meter was calibrated by checking the outdoor CO₂ levels which is known to be 400ppm. The group individually inputted data to a data sheet and analyzed the readings. This lab uses linear regression to determine time dependent variables and the ventilation rate of the study room. Determine the role that ventilation rates have in energy conservation and chemical exposure.

Lynn Brown
ENGR 115
Friday 11am
1-Apr-16

Input Parameters	
Measured Coutdoor	380
Assumed Coutdoor	400
Correction Factor	20

Analysis			
Measurement	Date and Time	HOBO CO2 concentration, ppm	ACTUAL CO2 CONCENTRATION ppm
	35 12:15:00 PM	766.8	786.8
	36 12:16:00 PM	768	788
	37 12:17:00 PM	774.7	794.7
	38 12:18:00 PM	735.7	755.7
	39 12:19:00 PM	736.9	756.9
	40 12:20:00 PM	772.9	792.9
	41 12:21:00 PM	735.7	755.7
	42 12:22:00 PM	727.7	747.7
	43 12:23:00 PM	747.3	767.3
	44 12:24:00 PM	721.6	741.6
	45 12:25:00 PM	703.3	723.3
	46 12:26:00 PM	701.5	721.5
	47 12:27:00 PM	706.3	726.3
	48 12:28:00 PM	701.5	721.5
	49 12:29:00 PM	694.7	714.7
	50 12:30:00 PM	658.7	678.7
	51 12:31:00 PM	667.9	687.9
	52 12:32:00 PM	660	680
	53 12:33:00 PM	641	661
	54 12:34:00 PM	632.5	652.5
	55 12:35:00 PM	619.7	639.7
	56 12:36:00 PM	623.3	643.3
	57 12:37:00 PM	638.6	658.6
	58 12:38:00 PM	628.8	648.8
	59 12:39:00 PM	605.6	625.6
	60 12:40:00 PM	606.8	626.8
	61 12:41:00 PM	580	600
	62 12:42:00 PM	586.1	606.1
	63 12:43:00 PM	586.1	606.1
	64 12:44:00 PM	576.9	596.9
	65 12:45:00 PM	580	600
	66 12:46:00 PM	576.3	596.3
	67 12:47:00 PM	569.6	589.6
	68 12:48:00 PM	568.4	588.4
	69 12:49:00 PM	553.7	573.7
	70 12:50:00 PM	562.3	582.3
	71 12:51:00 PM	555.6	575.6
	72 12:52:00 PM	561.7	581.7
	73 12:53:00 PM	551.3	571.3
	74 12:54:00 PM	541.5	561.5
	75 12:55:00 PM	553.7	573.7
	76 12:56:00 PM	553.1	573.1
	77 12:57:00 PM	543.3	563.3
	78 12:58:00 PM	529.3	549.3

CO_n concentrations vs time in minutes



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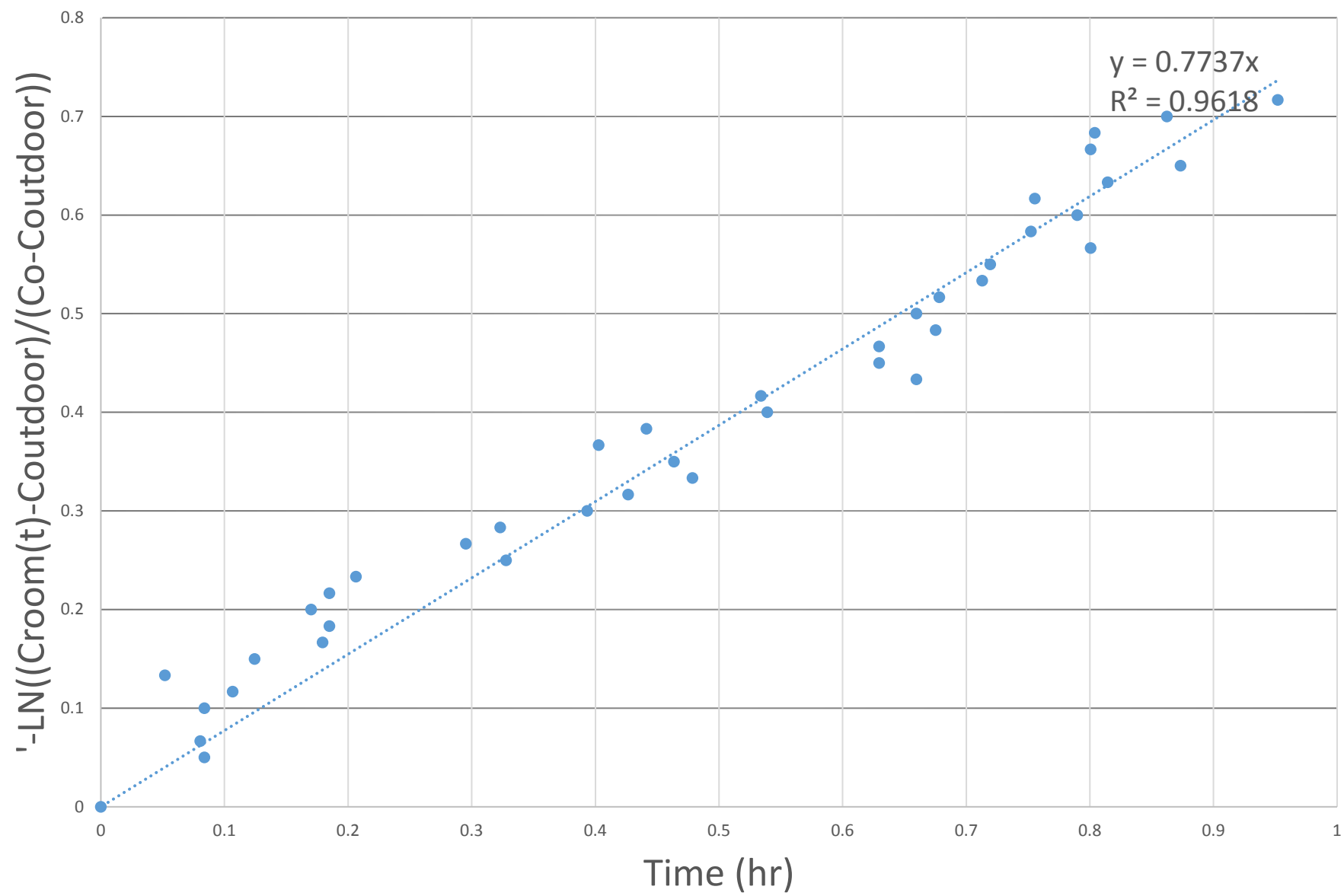
Input Parameters	
Measured Coudoor	380
Assumed Coudoor	400
Correction Factor	20

Dimensions of Room		in ft	in m
Length		21	6.4008
Width		11	3.3528
Height		9.5	2.8956
Volume (ft³ or m³)		2194.5	62.14131985

Analysis	Column1
Air Exchange Rate	0.7737
Time to Remove non-reactive Chemical (hr)	3.877471888
Ventilation Rate (ft³/min/person)	28.2980775
Room Capacity (people)	1

Analysis							
Measurement	Date and Time	Time in Minutes	HOBO CO2 concentration, ppm	ACTUAL CO2 CONCENTRATION pp	-LN((Croom(t)-Coutdoor)/(Co-Coutdoor)	Time in Hours	
	35 12:15:00 PM	0	766.8	786.8	0	0	0
	36 12:16:00 PM	1	768	788	-0.003097576		0.016666667
	37 12:17:00 PM	2	774.7	794.7	-0.002018219		0.093333333
	38 12:18:00 PM	3	735.7	755.7	0.083820085		0.05
	39 12:19:00 PM	4	736.9	756.9	0.080452133		0.066666667
	40 12:20:00 PM	5	772.9	792.9	-0.015647363		0.083333333
	41 12:21:00 PM	6	735.7	755.7	0.083820085		0.1
	42 12:22:00 PM	7	727.7	747.7	0.106567725		0.116666667
	43 12:23:00 PM	8	747.3	767.3	0.091728811		0.133333333
	44 12:24:00 PM	9	721.6	741.6	0.124267302		0.15
	45 12:25:00 PM	10	703.3	723.3	0.179327079		0.166666667
	46 12:26:00 PM	11	701.5	721.5	0.18491022		0.183333333
	47 12:27:00 PM	12	706.3	726.3	0.17009056		0.2
	48 12:28:00 PM	13	701.5	721.5	0.18491022		0.216666667
	49 12:29:00 PM	14	694.7	714.7	0.206267986		0.233333333
	50 12:30:00 PM	15	658.7	678.7	0.327771829		0.25
	51 12:31:00 PM	16	667.9	687.9	0.295294566		0.266666667
	52 12:32:00 PM	17	660	680	0.32311816		0.283333333
	53 12:33:00 PM	18	641	661	0.393387356		0.3
	54 12:34:00 PM	19	632.5	652.5	0.426496515		0.316666667
	55 12:35:00 PM	20	619.7	639.7	0.478519622		0.333333333
	56 12:36:00 PM	21	623.3	643.3	0.463612514		0.35
	57 12:37:00 PM	22	638.6	658.6	0.402625297		0.366666667
	58 12:38:00 PM	23	628.8	648.8	0.441258403		0.383333333
	59 12:39:00 PM	24	605.6	625.6	0.539144244		0.4
	60 12:40:00 PM	25	606.8	626.8	0.533839192		0.416666667
	61 12:41:00 PM	26	580	600	0.656950397		0.433333333
	62 12:42:00 PM	27	586.1	606.1	0.629546276		0.45
	63 12:43:00 PM	28	586.1	606.1	0.629546276		0.466666667
	64 12:44:00 PM	29	576.9	596.9	0.675211778		0.483333333
	65 12:45:00 PM	30	580	600	0.656950397		0.5
	66 12:46:00 PM	31	576.3	596.3	0.678263662		0.516666667
	67 12:47:00 PM	32	569.6	589.6	0.712991174		0.533333333
	68 12:48:00 PM	33	568.4	588.4	0.719340401		0.55
	69 12:49:00 PM	34	553.7	573.7	0.80057809		0.566666667
	70 12:50:00 PM	35	562.3	582.3	0.752254082		0.583333333
	71 12:51:00 PM	36	555.6	575.6	0.786895082		0.6
	72 12:52:00 PM	37	561.7	581.7	0.755550788		0.616666667
	73 12:53:00 PM	38	551.3	571.3	0.814481358		0.633333333
	74 12:54:00 PM	39	541.5	561.5	0.873402621		0.65
	75 12:55:00 PM	40	553.7	573.7	0.80057809		0.666666667
	76 12:56:00 PM	41	553.1	573.1	0.804038301		0.683333333
	77 12:57:00 PM	42	543.3	563.3	0.862318764		0.7
	78 12:58:00 PM	43	529.3	549.3	0.951950059		0.716666667

Determining the Air Exchange Rate for Library 312



CO2 Lab Questions

1) What is the air exchange rate (λ) of the room you tested? Be sure to include the units for the air exchange rate in your answer.

The Air Exchange Rate in the room was 0.7737/hr.

2) In general it takes $3/\lambda$ hours to remove a non-reactive chemical from indoor air. Based on this time, what recommendations would you make to the occupants of the room?

With four individuals in the room we got the room over 700 ppm within half an hour. To remove this it would take approximate 4 hours to clear out all the CO₂ accumulated. To improve ventilation I think users of the room should keep the door open to improve ventilation or only use the room for hour segments with a lot of time in between use.

3) Compare your ventilation rate for a typical number of occupants to the ASHRAE recommended ventilation rate. Based on this comparison, are the occupants wasting energy heating and cooling the air or are the occupants being too cheap and not supplying enough air? Justify your answer.

ASHRAE has a standard of 15scfm/person. The library study is meant to be a place for groups to work together. If you have more than one individual in the room, then you are not meeting the standard. It can be concluded that if the room is in use then it should be better ventilated. The library room need to be better ventilated for its users.

4) Given the ASHRAE standard ventilation standard, what is the maximum number of people you would recommend having in this room at one time? Use your model to determine this number.

Using the model my number was one person. If there was a second person the value falls below the 15scfm/person.

Plot Title: Library 312

Date Time, GMT-07:CO₂, ppm (LGR S/Host Connected (Stopped (LGR S/End Of File (LGR S/N: 9789942)

1	4/1/2016 11:41:00	654.5
2	4/1/2016 11:42:00	682.5
3	4/1/2016 11:43:00	636.1
4	4/1/2016 11:44:00	406
5	4/1/2016 11:45:00	402.9
6	4/1/2016 11:46:00	409.6
7	4/1/2016 11:47:00	382.2
8	4/1/2016 11:48:00	385.8
9	4/1/2016 11:49:00	378.5
10	4/1/2016 11:50:00	386.4
11	4/1/2016 11:51:00	449.9
12	4/1/2016 11:52:00	544.6
13	4/1/2016 11:53:00	562.3
14	4/1/2016 11:54:00	550.7
15	4/1/2016 11:55:00	557.4
16	4/1/2016 11:56:00	573.3
17	4/1/2016 11:57:00	617.8
18	4/1/2016 11:58:00	623.3
19	4/1/2016 11:59:00	640.4
20	4/1/2016 12:00:00	641
21	4/1/2016 12:01:00	642.9
22	4/1/2016 12:02:00	659.3
23	4/1/2016 12:03:00	670.9
24	4/1/2016 12:04:00	683.8
25	4/1/2016 12:05:00	700.9
26	4/1/2016 12:06:00	710.6
27	4/1/2016 12:07:00	679.5
28	4/1/2016 12:08:00	704.5
29	4/1/2016 12:09:00	703.3
30	4/1/2016 12:10:00	711.2
31	4/1/2016 12:11:00	734.4
32	4/1/2016 12:12:00	744.2
33	4/1/2016 12:13:00	733.8
34	4/1/2016 12:14:00	728.3
35	4/1/2016 12:15:00	766.8
36	4/1/2016 12:16:00	768
37	4/1/2016 12:17:00	774.7
38	4/1/2016 12:18:00	735.7
39	4/1/2016 12:19:00	736.9
40	4/1/2016 12:20:00	772.9
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43	4/1/2016 12:23:00	747.3
44	4/1/2016 12:24:00	721.6
45	4/1/2016 12:25:00	703.3
46	4/1/2016 12:26:00	701.5
47	4/1/2016 12:27:00	706.3
48	4/1/2016 12:28:00	701.5
49	4/1/2016 12:29:00	694.7
50	4/1/2016 12:30:00	658.7
51	4/1/2016 12:31:00	667.9
52	4/1/2016 12:32:00	660

53	4/1/2016 12:33:00	641			
54	4/1/2016 12:34:00	632.5			
55	4/1/2016 12:35:00	619.7			
56	4/1/2016 12:36:00	623.3			
57	4/1/2016 12:37:00	638.6			
58	4/1/2016 12:38:00	628.8			
59	4/1/2016 12:39:00	605.6			
60	4/1/2016 12:40:00	606.8			
61	4/1/2016 12:41:00	580			
62	4/1/2016 12:42:00	586.1			
63	4/1/2016 12:43:00	586.1			
64	4/1/2016 12:44:00	576.9			
65	4/1/2016 12:45:00	580			
66	4/1/2016 12:46:00	576.3			
67	4/1/2016 12:47:00	569.6			
68	4/1/2016 12:48:00	568.4			
69	4/1/2016 12:49:00	553.7			
70	4/1/2016 12:50:00	562.3			
71	4/1/2016 12:51:00	555.6			
72	4/1/2016 12:52:00	561.7			
73	4/1/2016 12:53:00	551.3			
74	4/1/2016 12:54:00	541.5			
75	4/1/2016 12:55:00	553.7			
76	4/1/2016 12:56:00	553.1			
77	4/1/2016 12:57:00	543.3			
78	4/1/2016 12:58:00	529.3			
79	4/1/2016 12:59:00	584.2			
80	4/1/2016 13:00:00	559.8			
81	4/1/2016 13:01:00	428			
82	4/1/2016 13:02:00	404.8			
83	4/1/2016 13:03:00	434.1			
84	4/1/2016 13:04:00	366.9			
85	4/1/2016 13:05:00	389.5			
86	4/1/2016 13:05:00		Logged		
87	4/1/2016 13:06:00			Logged	Logged