

# Predict house price in India

2023-08-16

## Introduction

My name is Dhanachote Weerachatsakul, i am studying in Data Rockie Boot camp Gen 8. Therefore, this is a second project for predicting house price in India, using dataset “House Price India” and ‘Rmarkdown’. The dataset is from **data.world**, this dataset will attract link in below.

## This is daset from data.world

House Price India

## Before Analyze House Price India dataset

I was collect the dataset from data.world by downloaded. The file’s House Price India is ‘.xlsx’ as known as Excel file. Firstly, I load the ‘library(readxl)’ to read the file for do the project and import it into ‘RStudio’. In the other hand, I check **NA** that the dataset can run in Rstudio.

```
## load library
library(tidyverse)

## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr      1.1.2      v readr      2.1.4
## v forcats    1.0.0      v stringr    1.5.0
## v ggplot2    3.4.3      v tibble     3.2.1
## v lubridate  1.9.2      v tidyr      1.3.0
## v purrr      1.0.2
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors

library(readxl)
library(caret)

## Loading required package: lattice
##
## Attaching package: 'caret'
##
## The following object is masked from 'package:purrr':
##
##   lift

library(ggplot2)

## import .xlsx

HPI <- read_excel("House Price India.xlsx")
```

```
## Check NA

HPI %>%
  complete.cases() %>%
  mean()
```

```
## [1] 1
```

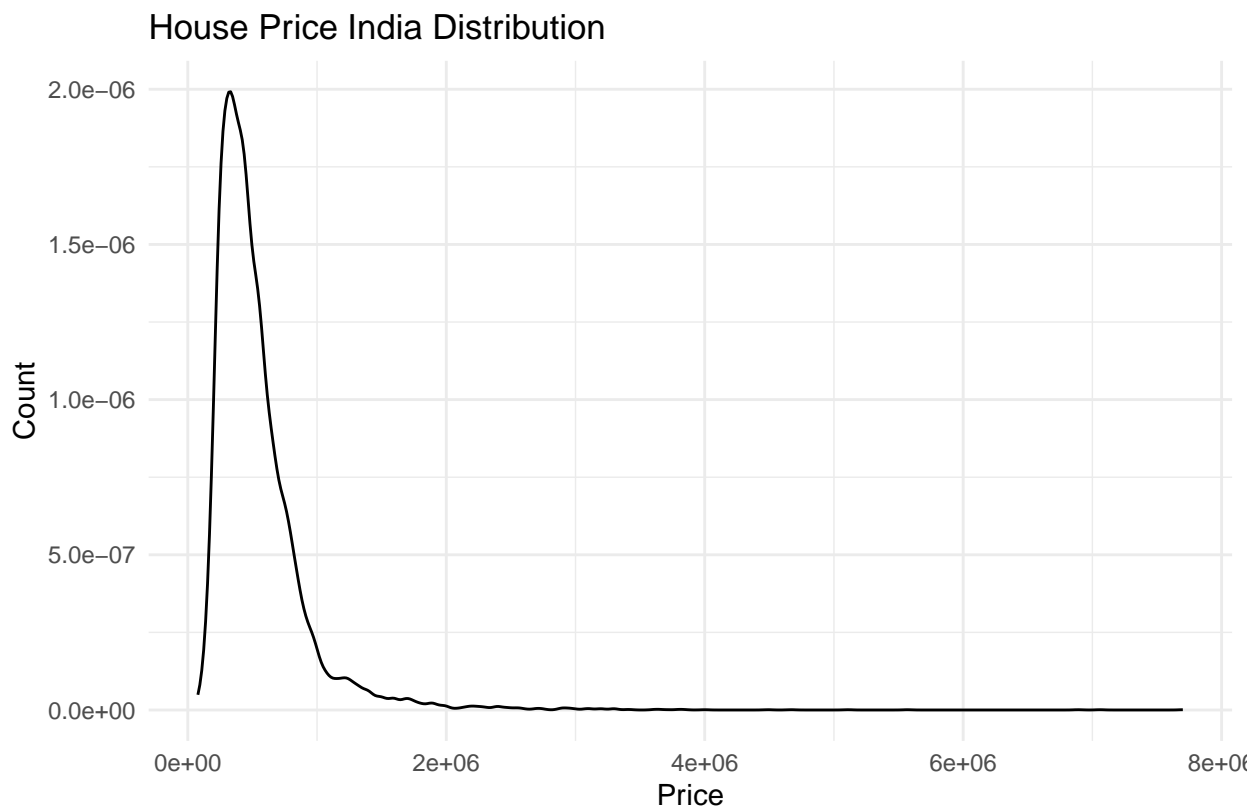
## [1] Prepare data

### The visualization House Price India

```
# Visualization predict variable price before prepare data

plot_1 <- ggplot(HPI, aes(Price)) +
  geom_density() +
  theme_minimal() +
  labs(
    title = "House Price India Distribution",
    x = "Price",
    y = "Count",
    caption = "Source: Dataset House Price India from data.world"
  )
```

```
plot_1
```



Source: Dataset House Price India from data.world

## Prediction price of house price in India by using regression model

Firstly, I decided to select five variable such as “Distance from the airport”, ” number of bedrooms”, “Number of schools nearby”, “living area”, and “Price”.

```
## select parameter

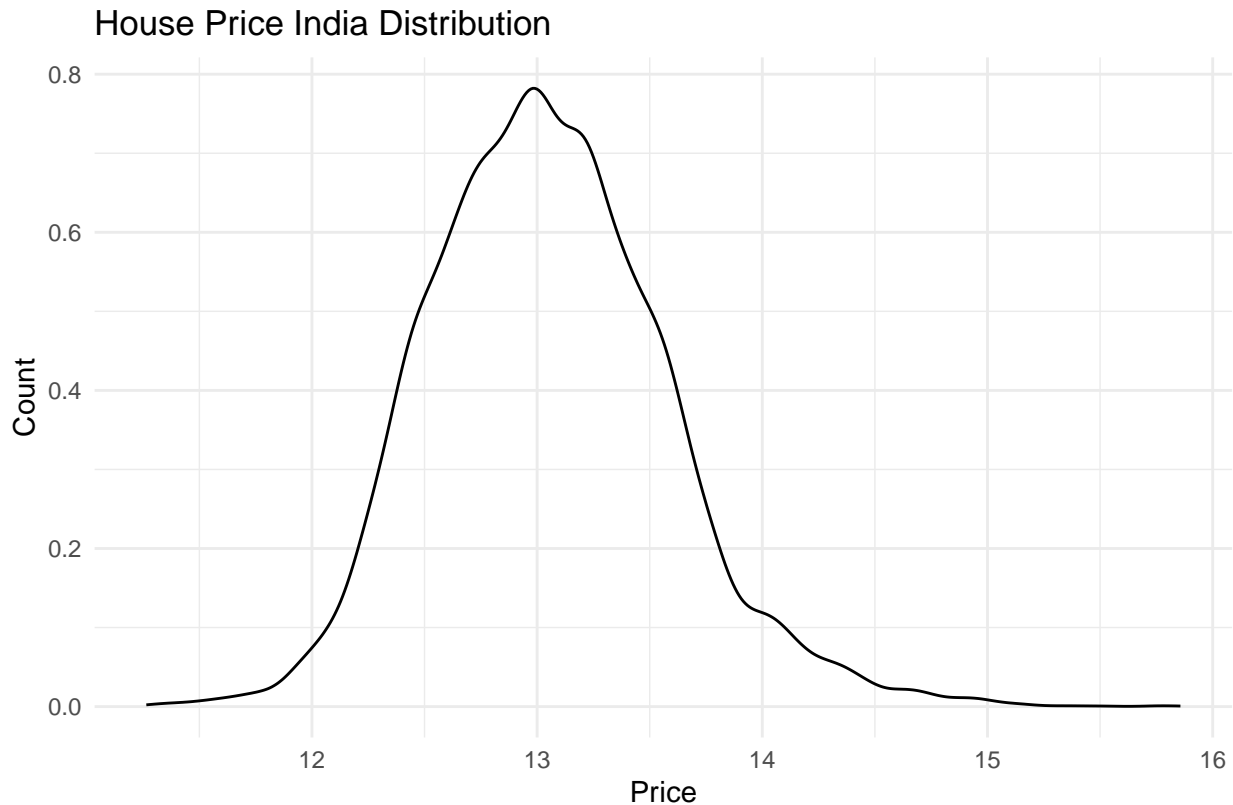
hpi_data <- HPI %>%
  select( price = Price,
          distance_airport = `Distance from the airport`,
          no_bedrooms = `number of bedrooms`,
          no_bathrooms = `number of bathrooms`,
          no_schools = `Number of schools nearby`,
          living_area = `living area`)
```

## The visualization after log\_price to normal distribution

```
## Visualization after log_Price

plot_2 <- ggplot(HPI, aes(log(Price))) +
  geom_density() +
  theme_minimal() +
  labs(
    title = "House Price India Distribution",
    x = "Price",
    y = "Count",
    caption = "Source: Dataset House Price India from data.world"
  )

plot_2
```



Source: Dataset House Price India from data.world

### Normal distribution by take log\_price

```
## normal distribution by take log_price
hpi_log <- hpi_data
hpi_log$price <- hpi_data$price %>%
  log()
```

## Train data

### Train, Test, and Split model

#### Create function and prep data

```
## create function

split_data <- function(HPI, train_size = 0.8) {
  set.seed(24)
  n <- nrow(hpi_data)
  id <- sample(1:n, size = n * train_size)
  train_data <- hpi_data[id,]
  test_data <- hpi_data[-id,]
  list(train = train_data,
       test = test_data)
}

## prep data
```

```

prep_data <- split_data(hpi_data)
train_data <- prep_data[[1]]
test_data <- prep_data[[2]]

```

## Normal Distribution by log\_price with train data and test data

```

## normalize price before train model

tr_log <- train_data
tr_log$price <- train_data$price %>%
log()

## test model

ts_log <- test_data
ts_log$price <- test_data$price %>%
log()

```

## Train model

```

## 2. train_model

set.seed(24)
model <- train(price ~. ,
               data = tr_log,
               method = "lm")

#view model
model

## Linear Regression
##
## 11696 samples
##    5 predictor
##
## No pre-processing
## Resampling: Bootstrapped (25 reps)
## Summary of sample sizes: 11696, 11696, 11696, 11696, 11696, 11696, ...
## Resampling results:
##
##   RMSE      Rsquared  MAE
## 0.3688012  0.508491  0.2980737
##
## Tuning parameter 'intercept' was held constant at a value of TRUE

```

## Scoring model using 'predict()'

```

## 3. scoring

p_log <- predict(model, newdata = ts_log)

p <- p_log %>%
exp()

```

*# view predict*

p

##	1	2	3	4	5	6	7
##	596533.5	586236.8	470100.6	589548.0	427953.7	622125.7	423698.6
##	8	9	10	11	12	13	14
##	574231.1	543169.8	49168009.4	553401.7	761513.2	389949.7	562581.2
##	15	16	17	18	19	20	21
##	375609.8	419056.5	629394.8	421128.1	417320.1	433054.3	328377.7
##	22	23	24	25	26	27	28
##	414531.1	1274800.6	783495.7	858189.1	932756.2	296351.0	378657.6
##	29	30	31	32	33	34	35
##	437893.1	540315.1	459245.9	427616.3	354457.8	333401.9	598025.8
##	36	37	38	39	40	41	42
##	332901.8	429506.9	347107.2	294810.2	291629.4	419749.0	393762.2
##	43	44	45	46	47	48	49
##	414342.0	560151.0	524566.1	438858.9	525888.4	428306.9	330164.6
##	50	51	52	53	54	55	56
##	329599.4	303595.0	316347.8	420347.4	282264.3	381644.3	275906.0
##	57	58	59	60	61	62	63
##	394880.1	302254.3	329009.7	745123.6	472057.7	662842.4	703361.2
##	64	65	66	67	68	69	70
##	737835.5	317233.4	546012.7	311648.7	324950.5	339973.4	384024.2
##	71	72	73	74	75	76	77
##	425597.4	528824.4	398963.7	427017.6	510284.8	406389.8	380101.9
##	78	79	80	81	82	83	84
##	336866.5	351289.4	1642023.8	887500.3	1059648.5	949249.7	526609.0
##	85	86	87	88	89	90	91
##	354133.3	422178.3	356686.2	381966.6	371906.6	466311.5	660366.8
##	92	93	94	95	96	97	98
##	560862.9	358841.3	396064.0	408423.3	353379.7	441870.0	458938.0
##	99	100	101	102	103	104	105
##	457744.7	360424.5	281289.3	290927.8	483286.6	323996.3	314865.0
##	106	107	108	109	110	111	112
##	643658.2	845233.4	726878.7	690979.2	1342700.6	514901.7	506193.2
##	113	114	115	116	117	118	119
##	895724.0	388690.1	470358.1	285677.8	402701.9	466984.2	322012.2
##	120	121	122	123	124	125	126
##	446021.7	290589.8	270132.3	286032.7	1189018.0	439263.5	439063.5
##	127	128	129	130	131	132	133
##	475746.5	329460.2	310299.4	374344.1	297496.3	412888.4	408235.9
##	134	135	136	137	138	139	140
##	292814.8	481588.9	473429.8	567344.4	734010.0	532462.9	494794.7
##	141	142	143	144	145	146	147
##	665388.1	323698.1	478360.7	350121.7	483552.2	323821.3	271601.3
##	148	149	150	151	152	153	154
##	301171.0	614037.3	639556.5	838320.5	723809.3	446220.5	715601.2
##	155	156	157	158	159	160	161
##	562770.0	438383.6	310215.5	340030.4	328545.5	483951.7	289997.5
##	162	163	164	165	166	167	168
##	484738.8	672077.9	490491.1	343660.1	527116.3	338894.1	481938.5
##	169	170	171	172	173	174	175
##	456875.9	490288.7	360222.1	600927.4	399969.3	283535.9	367156.0

##	176	177	178	179	180	181	182
##	811276.7	495154.8	1031639.4	528169.2	375731.2	354979.5	499155.8
##	183	184	185	186	187	188	189
##	390634.2	311587.7	269903.2	409746.2	362605.8	477919.0	436234.0
##	190	191	192	193	194	195	196
##	347522.6	284579.6	282820.0	483642.2	792759.4	704835.4	506873.4
##	197	198	199	200	201	202	203
##	359011.9	567786.6	594307.7	562104.4	590777.5	605004.3	337814.3
##	204	205	206	207	208	209	210
##	709757.2	440183.8	453749.6	323368.6	306172.3	395592.1	475378.7
##	211	212	213	214	215	216	217
##	606238.2	297830.5	298683.9	450280.4	372872.1	333901.3	278202.4
##	218	219	220	221	222	223	224
##	384512.8	294021.5	945464.3	448088.6	1053427.5	1399574.9	622375.4
##	225	226	227	228	229	230	231
##	567751.6	530973.3	632649.9	489555.4	737691.0	373366.1	547722.4
##	232	233	234	235	236	237	238
##	315494.1	374534.6	493400.7	278093.5	348192.8	459900.5	301647.7
##	239	240	241	242	243	244	245
##	321589.8	359719.2	326825.0	328389.7	288318.8	2186550.4	1107122.6
##	246	247	248	249	250	251	252
##	458709.6	507650.4	471414.0	720837.4	652703.8	400693.1	370284.4
##	253	254	255	256	257	258	259
##	506456.8	257695.1	693239.4	521071.4	280959.6	298956.3	317640.4
##	260	261	262	263	264	265	266
##	391724.7	563839.4	336135.5	558711.3	1199789.1	761349.4	540618.0
##	267	268	269	270	271	272	273
##	551280.1	329527.9	342301.3	565008.4	397414.5	395543.4	398015.8
##	274	275	276	277	278	279	280
##	280445.8	337962.1	352221.2	397261.4	433069.4	348704.3	340848.2
##	281	282	283	284	285	286	287
##	252281.2	2010617.3	333805.6	556044.7	390115.1	473849.7	424085.1
##	288	289	290	291	292	293	294
##	413022.6	588614.3	588197.4	539329.6	1435504.3	576241.3	424472.5
##	295	296	297	298	299	300	301
##	440781.7	359073.1	621718.8	404534.6	488810.7	327412.7	438023.4
##	302	303	304	305	306	307	308
##	408995.9	390081.4	326838.5	1108934.0	1344980.5	457506.0	611211.2
##	309	310	311	312	313	314	315
##	519196.5	382253.2	520631.9	350130.0	397499.0	362477.2	510301.7
##	316	317	318	319	320	321	322
##	347585.9	327847.9	473024.0	340239.7	374190.5	282466.4	2127180.3
##	323	324	325	326	327	328	329
##	626683.1	367056.0	487412.9	360203.4	280353.8	291838.8	370360.3
##	330	331	332	333	334	335	336
##	315722.4	355712.7	319458.3	289583.1	693645.4	631242.0	499302.5
##	337	338	339	340	341	342	343
##	704368.8	602493.3	455540.0	634181.4	472120.6	377382.3	374857.4
##	344	345	346	347	348	349	350
##	432416.5	306635.1	387166.9	341145.3	554231.6	408422.5	687181.0
##	351	352	353	354	355	356	357
##	507346.8	621227.5	688717.6	736732.2	582836.5	455687.8	411164.1
##	358	359	360	361	362	363	364
##	405664.3	323631.1	318082.0	444186.0	335735.0	346189.7	426225.9

##	365	366	367	368	369	370	371
##	1099523.5	1262766.4	861228.2	370923.1	490134.6	624608.0	548156.7
##	372	373	374	375	376	377	378
##	604116.2	563761.6	445556.2	382887.7	588423.4	425720.5	456341.6
##	379	380	381	382	383	384	385
##	349814.4	318858.9	432126.2	398907.2	323863.5	356965.6	319479.2
##	386	387	388	389	390	391	392
##	302392.4	317613.0	327673.8	763290.7	1181658.7	600302.5	407874.4
##	393	394	395	396	397	398	399
##	423946.7	516926.8	557470.9	293177.6	414289.6	530237.1	472479.2
##	400	401	402	403	404	405	406
##	386299.2	472777.1	454660.3	468207.2	283187.7	348462.2	497544.4
##	407	408	409	410	411	412	413
##	550204.4	359534.8	308171.2	841922.6	428776.6	508857.1	369025.0
##	414	415	416	417	418	419	420
##	377636.6	442137.2	378154.4	333650.7	534371.3	647808.8	343466.0
##	421	422	423	424	425	426	427
##	406154.8	505171.2	530731.8	448881.2	528003.0	294865.2	405831.0
##	428	429	430	431	432	433	434
##	450714.7	422936.4	456077.9	379637.1	1142907.5	577642.1	689518.1
##	435	436	437	438	439	440	441
##	665791.6	471695.5	522169.6	470439.2	448078.0	432350.9	430319.7
##	442	443	444	445	446	447	448
##	612128.1	358680.1	447397.5	276825.7	416022.4	1202760.3	519478.8
##	449	450	451	452	453	454	455
##	325989.0	362941.3	1074491.3	445630.7	505401.1	453036.2	456360.6
##	456	457	458	459	460	461	462
##	452971.6	580036.9	443854.8	337297.9	292544.7	423382.1	427392.4
##	463	464	465	466	467	468	469
##	403201.6	862810.0	668312.0	911864.5	750757.8	586879.2	580395.8
##	470	471	472	473	474	475	476
##	465876.0	569193.9	1029194.0	558900.8	384136.8	367231.3	441931.0
##	477	478	479	480	481	482	483
##	436822.2	366642.6	371471.3	406041.2	442700.5	354072.0	279188.0
##	484	485	486	487	488	489	490
##	340105.3	365814.4	283577.6	1056388.4	542963.5	510194.4	498776.8
##	491	492	493	494	495	496	497
##	373629.1	574144.3	703131.5	391407.9	276106.7	319340.9	368888.6
##	498	499	500	501	502	503	504
##	556721.6	410454.5	367171.5	325999.7	542548.1	519952.6	1000658.8
##	505	506	507	508	509	510	511
##	456043.8	575672.6	560161.8	864827.4	468600.0	372832.0	417274.3
##	512	513	514	515	516	517	518
##	693013.3	438743.6	629778.7	410562.1	342498.8	293235.0	377279.4
##	519	520	521	522	523	524	525
##	417070.3	319857.3	388371.2	250214.2	418217.3	995352.8	594686.2
##	526	527	528	529	530	531	532
##	478530.3	675447.4	514604.9	440223.0	539435.4	407240.5	372779.2
##	533	534	535	536	537	538	539
##	455381.7	436357.1	365665.2	434245.4	321044.2	322138.3	581972.5
##	540	541	542	543	544	545	546
##	320062.3	323020.5	612466.1	659680.1	704506.7	541651.3	462852.3
##	547	548	549	550	551	552	553
##	361659.4	289428.8	352394.4	449124.1	316028.5	393130.3	397540.4



##	554	555	556	557	558	559	560
##	1078899.4	651442.5	632744.4	799229.1	380524.0	521722.0	361855.0
##	561	562	563	564	565	566	567
##	533504.4	380676.8	291401.1	505237.1	394803.7	390038.0	384328.6
##	568	569	570	571	572	573	574
##	335656.0	418021.5	485187.4	364410.1	347636.1	274469.5	562329.7
##	575	576	577	578	579	580	581
##	382626.3	303479.0	350630.9	322411.5	1341042.9	700427.2	659458.8
##	582	583	584	585	586	587	588
##	604628.9	545224.3	399271.1	598864.1	424781.4	691594.3	450722.3
##	589	590	591	592	593	594	595
##	441849.6	386204.8	395488.2	459699.8	443396.5	599162.0	574312.4
##	596	597	598	599	600	601	602
##	456231.8	424875.8	387569.4	434136.9	430002.0	1459403.8	732459.0
##	603	604	605	606	607	608	609
##	554960.5	461434.2	568008.9	491508.5	446268.1	317888.0	397597.0
##	610	611	612	613	614	615	616
##	648747.7	326009.1	319299.2	376539.5	429238.5	432439.0	294153.2
##	617	618	619	620	621	622	623
##	312505.7	350935.1	302310.1	1764294.7	749423.4	773825.1	2775535.5
##	624	625	626	627	628	629	630
##	713748.2	567900.0	681020.0	466944.9	644097.1	701713.7	433878.6
##	631	632	633	634	635	636	637
##	454146.8	358295.8	572284.0	420360.1	475143.5	552917.1	346528.1
##	638	639	640	641	642	643	644
##	551010.3	513276.3	365114.0	421466.8	447840.0	424044.3	285806.2
##	645	646	647	648	649	650	651
##	293708.8	323951.1	362126.8	282911.8	336732.1	305065.1	501518.2
##	652	653	654	655	656	657	658
##	848542.4	664918.0	380345.8	350902.3	377931.1	366252.4	371447.3
##	659	660	661	662	663	664	665
##	413440.3	338732.8	287245.8	519158.0	586668.9	303660.9	334841.3
##	666	667	668	669	670	671	672
##	573706.8	561153.8	305445.1	327073.2	327982.8	307627.7	619604.9
##	673	674	675	676	677	678	679
##	479481.7	846205.2	996886.8	513362.6	703423.5	526036.8	502114.7
##	680	681	682	683	684	685	686
##	543944.1	567910.5	1248483.8	368276.6	488080.8	356184.3	409434.7
##	687	688	689	690	691	692	693
##	342353.2	480816.0	562093.3	474076.9	447101.4	341685.4	275999.1
##	694	695	696	697	698	699	700
##	578991.2	937122.3	473387.8	550252.7	414193.1	536510.4	431128.1
##	701	702	703	704	705	706	707
##	424655.7	340934.0	430250.5	503660.3	524213.0	504214.4	442756.1
##	708	709	710	711	712	713	714
##	438073.1	373398.8	523565.2	278003.8	315217.4	357082.1	319500.0
##	715	716	717	718	719	720	721
##	306987.1	565084.2	1024932.0	825379.1	696843.7	460894.4	403433.8
##	722	723	724	725	726	727	728
##	590775.9	358405.7	368569.3	438361.8	561198.1	415144.5	367003.8
##	729	730	731	732	733	734	735
##	345811.0	414234.0	381565.0	461568.7	309219.7	562543.7	480561.5
##	736	737	738	739	740	741	742
##	260111.3	710048.6	391231.9	528214.6	365764.2	295348.8	364187.6

##	743	744	745	746	747	748	749
##	324692.3	399490.8	521394.8	554125.1	318248.1	1089437.3	280901.4
##	750	751	752	753	754	755	756
##	335578.0	653043.4	345532.1	408769.9	284129.5	332126.4	398010.9
##	757	758	759	760	761	762	763
##	414755.9	352079.9	435661.0	350738.8	285697.0	698684.3	454750.4
##	764	765	766	767	768	769	770
##	377452.8	1451189.0	574497.8	448657.2	423882.2	721219.5	470311.0
##	771	772	773	774	775	776	777
##	740239.7	472849.5	502176.9	517409.5	297784.9	420666.1	404559.5
##	778	779	780	781	782	783	784
##	449295.0	3637925.5	1084169.5	655741.0	740030.9	993142.5	1056240.7
##	785	786	787	788	789	790	791
##	981806.1	616345.5	420131.9	568106.8	401055.6	357969.9	308650.8
##	792	793	794	795	796	797	798
##	391361.3	678621.9	407711.5	348624.6	332094.0	333145.6	411516.1
##	799	800	801	802	803	804	805
##	462271.7	496030.0	411020.5	320699.3	281417.3	777070.9	574468.1
##	806	807	808	809	810	811	812
##	513845.1	610264.0	435789.0	371003.4	446816.6	539558.8	291768.8
##	813	814	815	816	817	818	819
##	462918.8	364654.5	439197.9	448549.6	325466.6	330106.7	404723.3
##	820	821	822	823	824	825	826
##	1598218.0	523145.5	698509.1	649387.9	545928.7	516161.4	509243.8
##	827	828	829	830	831	832	833
##	444760.0	345179.6	477431.3	376302.3	447058.6	499096.9	443333.6
##	834	835	836	837	838	839	840
##	261556.9	454084.0	718152.1	1775949.5	411390.4	796227.6	424932.2
##	841	842	843	844	845	846	847
##	509947.0	581442.1	528054.6	436531.6	468934.9	580180.4	403950.5
##	848	849	850	851	852	853	854
##	459330.7	362740.9	499493.1	326282.8	393980.5	496815.6	301405.8
##	855	856	857	858	859	860	861
##	336936.1	283448.6	299092.9	328185.5	1188166.0	962877.6	625901.7
##	862	863	864	865	866	867	868
##	548244.0	1399464.4	719689.1	801696.3	817353.9	1706874.5	653256.8
##	869	870	871	872	873	874	875
##	592144.9	545367.4	298086.1	373593.2	395797.3	343921.3	480961.8
##	876	877	878	879	880	881	882
##	296392.4	442348.6	339232.2	317678.8	324320.6	310473.8	1489195.8
##	883	884	885	886	887	888	889
##	854546.3	1226559.6	616982.9	465134.5	541224.0	705861.3	590541.0
##	890	891	892	893	894	895	896
##	421507.1	446288.0	471255.0	819068.5	524775.4	506917.3	437903.2
##	897	898	899	900	901	902	903
##	584032.1	442925.4	329999.3	366521.6	285616.1	373785.0	433389.3
##	904	905	906	907	908	909	910
##	297410.2	346417.7	233139.8	1916657.6	743442.4	1054864.6	966638.2
##	911	912	913	914	915	916	917
##	624532.3	749925.4	366415.7	566342.5	620363.7	335156.9	314274.5
##	918	919	920	921	922	923	924
##	382419.2	380457.5	272664.7	411194.0	385934.0	378945.5	299853.8
##	925	926	927	928	929	930	931
##	820017.4	1204181.2	818436.8	746939.5	706712.4	858684.1	454457.1

##	932	933	934	935	936	937	938
##	696094.8	470406.6	457302.2	572558.1	371121.5	480973.1	345911.9
##	939	940	941	942	943	944	945
##	428229.1	439727.4	370270.5	375080.6	384640.6	503425.4	474102.6
##	946	947	948	949	950	951	952
##	404350.0	279955.2	357896.3	356515.8	440997.3	441141.4	501082.6
##	953	954	955	956	957	958	959
##	703498.9	541822.8	438630.7	747474.5	389624.2	396219.1	483448.4
##	960	961	962	963	964	965	966
##	337949.6	473551.3	301848.7	317316.8	355079.8	305269.9	269567.4
##	967	968	969	970	971	972	973
##	279936.9	330165.5	341436.7	339392.9	881929.8	891986.0	666435.9
##	974	975	976	977	978	979	980
##	508682.4	535144.0	391389.6	553588.1	430295.8	547798.9	505764.0
##	981	982	983	984	985	986	987
##	600921.8	399339.7	450393.9	504135.7	296591.1	458525.8	460913.6
##	988	989	990	991	992	993	994
##	406645.4	322478.0	450520.1	427073.3	410026.2	295095.2	428768.5
##	995	996	997	998	999	1000	1001
##	399125.7	340147.0	250657.7	602178.9	454966.5	495147.8	463668.7
##	1002	1003	1004	1005	1006	1007	1008
##	554164.4	472166.6	416349.2	510055.6	471209.7	364938.8	520259.2
##	1009	1010	1011	1012	1013	1014	1015
##	503786.6	284155.4	288544.7	331092.9	496697.1	496508.2	302115.7
##	1016	1017	1018	1019	1020	1021	1022
##	478552.6	412180.9	312740.4	392537.0	329764.5	301915.8	362217.7
##	1023	1024	1025	1026	1027	1028	1029
##	362751.3	1052340.9	600033.9	635262.1	460279.0	519889.8	476118.3
##	1030	1031	1032	1033	1034	1035	1036
##	477581.8	378789.8	412616.0	296990.3	452607.7	364817.2	385481.4
##	1037	1038	1039	1040	1041	1042	1043
##	441625.2	376478.2	320549.2	315943.1	265186.4	358603.3	371368.6
##	1044	1045	1046	1047	1048	1049	1050
##	1706138.7	594603.1	534667.6	652362.0	420912.2	332292.8	421617.1
##	1051	1052	1053	1054	1055	1056	1057
##	561483.4	336045.7	534969.4	414639.7	642815.1	505468.0	495335.1
##	1058	1059	1060	1061	1062	1063	1064
##	396585.8	545183.5	407772.5	476030.8	485850.8	518922.8	747385.2
##	1065	1066	1067	1068	1069	1070	1071
##	852416.6	791043.0	506094.3	544279.0	408934.6	430681.1	972086.9
##	1072	1073	1074	1075	1076	1077	1078
##	836918.2	525345.6	473825.1	684472.1	394751.8	268006.9	582048.7
##	1079	1080	1081	1082	1083	1084	1085
##	456837.3	348148.5	319585.8	344274.3	358604.4	353173.4	268391.0
##	1086	1087	1088	1089	1090	1091	1092
##	796187.2	872585.0	631783.6	479111.7	586232.2	910163.5	541041.5
##	1093	1094	1095	1096	1097	1098	1099
##	476593.0	606961.1	503115.4	473937.9	528199.7	437187.3	280028.3
##	1100	1101	1102	1103	1104	1105	1106
##	365786.9	398732.4	364860.8	371173.0	466762.1	302451.6	328467.0
##	1107	1108	1109	1110	1111	1112	1113
##	360929.7	453416.6	354926.6	471511.1	666920.9	529644.3	632579.3
##	1114	1115	1116	1117	1118	1119	1120
##	338008.8	602133.8	541435.9	456287.1	483994.4	422873.2	584185.6

##	1121	1122	1123	1124	1125	1126	1127
##	281640.9	310916.4	350015.8	504638.2	338144.4	358653.4	950423.2
##	1128	1129	1130	1131	1132	1133	1134
##	838748.9	867635.9	545520.1	498198.1	370356.4	484634.7	610463.4
##	1135	1136	1137	1138	1139	1140	1141
##	670003.3	368700.0	447554.2	331014.9	411742.0	336877.5	314471.1
##	1142	1143	1144	1145	1146	1147	1148
##	369249.1	369197.4	285134.1	454754.6	509874.6	392772.5	369990.3
##	1149	1150	1151	1152	1153	1154	1155
##	449223.3	461864.8	892570.6	313550.9	367965.1	347680.5	336578.0
##	1156	1157	1158	1159	1160	1161	1162
##	600498.3	318230.3	401498.1	522243.7	324218.0	377534.8	389609.7
##	1163	1164	1165	1166	1167	1168	1169
##	304934.2	297203.6	561213.7	459002.6	279261.4	2154270.5	1107061.6
##	1170	1171	1172	1173	1174	1175	1176
##	1077624.4	398015.3	298895.6	354441.2	390661.2	319212.8	510145.4
##	1177	1178	1179	1180	1181	1182	1183
##	418849.4	585976.6	325627.6	517437.1	452343.6	440191.0	372925.1
##	1184	1185	1186	1187	1188	1189	1190
##	287996.4	1831431.4	561842.0	595196.4	572104.6	387273.1	423692.6
##	1191	1192	1193	1194	1195	1196	1197
##	405637.8	400581.5	357764.7	336760.9	480842.9	305604.6	322950.5
##	1198	1199	1200	1201	1202	1203	1204
##	501982.1	336597.0	466124.4	298917.9	536492.9	624841.3	587388.6
##	1205	1206	1207	1208	1209	1210	1211
##	690618.3	302034.6	332977.8	530133.3	459874.8	299697.4	342356.6
##	1212	1213	1214	1215	1216	1217	1218
##	324732.3	317585.5	533694.7	632236.1	416795.1	349764.7	380631.4
##	1219	1220	1221	1222	1223	1224	1225
##	314008.1	325053.3	433539.2	360583.6	365454.7	413766.6	339453.0
##	1226	1227	1228	1229	1230	1231	1232
##	300469.1	289036.2	1079294.3	571917.0	611895.3	505726.1	552891.5
##	1233	1234	1235	1236	1237	1238	1239
##	323544.3	298683.3	314080.6	395266.1	388788.5	471870.4	528655.9
##	1240	1241	1242	1243	1244	1245	1246
##	340423.5	345319.3	325982.0	8631437.7	896959.3	359773.5	352075.5
##	1247	1248	1249	1250	1251	1252	1253
##	657736.3	396787.6	364416.0	449954.1	495008.8	536679.5	356427.5
##	1254	1255	1256	1257	1258	1259	1260
##	535223.9	373082.1	374458.3	449090.4	418053.5	381030.9	344447.7
##	1261	1262	1263	1264	1265	1266	1267
##	284373.3	947418.9	1147373.3	511063.8	1197690.3	655179.8	634967.0
##	1268	1269	1270	1271	1272	1273	1274
##	554269.7	657003.1	477961.4	432899.7	360484.3	436759.6	563814.5
##	1275	1276	1277	1278	1279	1280	1281
##	527681.8	396188.7	411003.2	451053.7	302614.8	450242.7	365577.2
##	1282	1283	1284	1285	1286	1287	1288
##	329617.1	380549.5	293767.3	417438.2	329885.2	738412.1	532999.6
##	1289	1290	1291	1292	1293	1294	1295
##	681172.5	566599.0	370170.4	502028.3	378933.1	634156.2	578138.9
##	1296	1297	1298	1299	1300	1301	1302
##	408800.3	392585.7	417515.2	405992.9	348261.0	349510.5	305048.5
##	1303	1304	1305	1306	1307	1308	1309
##	442396.9	445659.8	346277.1	494220.4	355554.5	403388.8	381416.4

##	1310	1311	1312	1313	1314	1315	1316
##	339364.5	318461.1	1224553.3	519952.6	449593.2	341144.4	348491.6
##	1317	1318	1319	1320	1321	1322	1323
##	439035.8	373418.6	579697.4	313698.5	290606.3	726736.2	689950.6
##	1324	1325	1326	1327	1328	1329	1330
##	511703.0	417057.4	357706.1	287996.5	355925.1	565726.6	423132.9
##	1331	1332	1333	1334	1335	1336	1337
##	460304.8	561934.6	432242.5	413281.6	327193.9	334462.8	303753.6
##	1338	1339	1340	1341	1342	1343	1344
##	436854.3	335978.7	367925.7	489900.4	2519894.1	585124.9	568805.1
##	1345	1346	1347	1348	1349	1350	1351
##	361212.4	595501.4	804700.3	439267.6	387691.6	443420.3	299599.1
##	1352	1353	1354	1355	1356	1357	1358
##	296508.5	521054.9	627842.5	366912.1	347571.1	414477.3	423864.3
##	1359	1360	1361	1362	1363	1364	1365
##	391568.8	321541.7	364575.2	404586.1	448665.9	277025.0	334827.9
##	1366	1367	1368	1369	1370	1371	1372
##	295967.2	563563.3	521737.6	522345.0	343100.6	397277.9	443508.0
##	1373	1374	1375	1376	1377	1378	1379
##	502340.7	412043.0	482912.4	501021.8	746304.5	326072.9	695325.8
##	1380	1381	1382	1383	1384	1385	1386
##	391662.5	411171.9	473690.6	413713.3	557203.1	342825.4	375935.8
##	1387	1388	1389	1390	1391	1392	1393
##	439383.2	453315.1	372512.1	515118.8	318250.5	383383.4	292795.7
##	1394	1395	1396	1397	1398	1399	1400
##	936196.5	759538.5	802781.1	373541.2	493335.4	304097.1	452427.0
##	1401	1402	1403	1404	1405	1406	1407
##	409173.4	403471.5	1141324.9	1441851.0	605822.9	717483.5	859550.8
##	1408	1409	1410	1411	1412	1413	1414
##	452996.0	522369.2	449553.6	415865.0	575682.9	701335.4	331481.4
##	1415	1416	1417	1418	1419	1420	1421
##	357962.3	375588.1	703292.3	455722.6	415778.3	283354.1	446621.2
##	1422	1423	1424	1425	1426	1427	1428
##	427109.5	302490.5	911598.8	890450.0	972878.0	348061.2	597630.2
##	1429	1430	1431	1432	1433	1434	1435
##	294615.2	401498.1	363808.2	355338.2	452520.7	293600.3	361635.7
##	1436	1437	1438	1439	1440	1441	1442
##	362342.9	313283.3	865671.6	274272.6	645156.1	470709.1	618739.8
##	1443	1444	1445	1446	1447	1448	1449
##	563636.8	663807.5	399153.5	478017.2	779469.0	339402.5	549299.1
##	1450	1451	1452	1453	1454	1455	1456
##	301091.3	456662.1	296548.9	336789.4	309280.3	398751.6	368765.0
##	1457	1458	1459	1460	1461	1462	1463
##	326051.7	711844.3	563467.4	493394.6	346546.9	349238.2	380578.4
##	1464	1465	1466	1467	1468	1469	1470
##	471291.2	512484.1	417438.0	414617.2	487768.7	274755.7	320920.2
##	1471	1472	1473	1474	1475	1476	1477
##	282193.7	1107456.0	875317.3	1273094.8	484052.0	494279.3	672560.7
##	1478	1479	1480	1481	1482	1483	1484
##	303071.7	448682.3	525409.3	425444.7	396377.9	557869.0	426762.3
##	1485	1486	1487	1488	1489	1490	1491
##	540097.2	580664.8	527745.8	332674.9	436044.2	559524.5	495299.1
##	1492	1493	1494	1495	1496	1497	1498
##	514186.4	279184.9	391622.6	277241.5	493651.6	431960.9	409076.0

##	1499	1500	1501	1502	1503	1504	1505
##	373670.1	958396.2	694947.3	1311827.5	1052820.7	420027.0	438658.5
##	1506	1507	1508	1509	1510	1511	1512
##	521302.8	528061.9	416212.6	467297.1	473810.7	396064.9	413969.1
##	1513	1514	1515	1516	1517	1518	1519
##	409235.5	434287.5	415576.3	396477.0	457596.2	423500.8	413955.6
##	1520	1521	1522	1523	1524	1525	1526
##	312696.0	369774.4	474570.6	507782.0	430607.8	274773.7	863101.4
##	1527	1528	1529	1530	1531	1532	1533
##	632909.6	545224.3	420812.0	490463.6	558232.1	517019.8	454178.1
##	1534	1535	1536	1537	1538	1539	1540
##	337290.9	465997.6	709909.6	476335.2	326123.0	409679.2	311385.7
##	1541	1542	1543	1544	1545	1546	1547
##	276034.7	443021.3	401138.6	416776.7	567786.6	365140.8	843023.1
##	1548	1549	1550	1551	1552	1553	1554
##	1196526.6	651974.1	700701.5	744713.7	711034.7	881018.9	348511.7
##	1555	1556	1557	1558	1559	1560	1561
##	297474.2	331831.0	298586.5	491636.2	840822.3	331079.7	515391.6
##	1562	1563	1564	1565	1566	1567	1568
##	287903.6	335779.4	361298.6	314615.4	417437.3	287098.0	700611.3
##	1569	1570	1571	1572	1573	1574	1575
##	834370.9	333566.7	451040.2	375210.4	407202.4	523163.9	364225.8
##	1576	1577	1578	1579	1580	1581	1582
##	352816.7	536539.5	352887.1	394827.9	414013.8	392688.4	409662.2
##	1583	1584	1585	1586	1587	1588	1589
##	314421.1	273197.4	1150282.1	688428.3	1279135.1	322894.0	856087.2
##	1590	1591	1592	1593	1594	1595	1596
##	525962.1	462888.6	583266.1	462426.8	440959.2	315829.5	439170.2
##	1597	1598	1599	1600	1601	1602	1603
##	495918.1	502994.8	606803.7	446420.2	454428.3	326052.8	316075.8
##	1604	1605	1606	1607	1608	1609	1610
##	289523.7	330777.4	343522.3	321363.3	301490.3	2402769.3	565463.5
##	1611	1612	1613	1614	1615	1616	1617
##	769062.3	854844.4	1011596.8	415500.5	665525.7	429033.4	671421.9
##	1618	1619	1620	1621	1622	1623	1624
##	405081.2	259026.9	300628.3	1445691.3	528754.5	371416.0	612140.8
##	1625	1626	1627	1628	1629	1630	1631
##	395488.9	373071.1	381475.4	428894.2	353992.5	502144.1	291783.8
##	1632	1633	1634	1635	1636	1637	1638
##	411105.0	967130.1	785423.3	522612.7	387763.8	470500.6	646253.8
##	1639	1640	1641	1642	1643	1644	1645
##	293999.1	534492.9	408184.2	379230.0	352295.1	477283.1	375349.2
##	1646	1647	1648	1649	1650	1651	1652
##	298062.6	1116966.6	1756251.3	744219.3	474473.1	513143.5	687203.1
##	1653	1654	1655	1656	1657	1658	1659
##	403494.9	507507.4	450138.8	322793.0	470832.2	330979.3	367299.1
##	1660	1661	1662	1663	1664	1665	1666
##	304628.0	501980.3	438527.2	346855.6	414775.0	659514.3	427249.2
##	1667	1668	1669	1670	1671	1672	1673
##	309623.0	412573.9	365344.1	371757.6	342829.3	368079.8	318027.3
##	1674	1675	1676	1677	1678	1679	1680
##	342144.4	474699.5	491503.8	342045.5	410244.2	260637.0	343756.2
##	1681	1682	1683	1684	1685	1686	1687
##	278220.6	978766.5	791006.1	470259.4	392815.8	611476.2	397350.6

##	1688	1689	1690	1691	1692	1693	1694
##	344978.1	505753.3	477551.5	292028.8	422473.2	334741.6	481975.5
##	1695	1696	1697	1698	1699	1700	1701
##	621787.0	363950.7	668086.6	532768.6	518482.3	348862.3	314755.1
##	1702	1703	1704	1705	1706	1707	1708
##	329742.4	298525.2	547299.5	1340797.6	730706.6	405236.3	549153.3
##	1709	1710	1711	1712	1713	1714	1715
##	298240.7	322776.5	316034.5	289456.8	925265.5	421331.8	505260.3
##	1716	1717	1718	1719	1720	1721	1722
##	543199.0	364979.9	384561.8	852392.3	378731.7	478210.1	310575.1
##	1723	1724	1725	1726	1727	1728	1729
##	574193.6	485155.7	611186.5	282488.5	289393.7	356033.9	277843.2
##	1730	1731	1732	1733	1734	1735	1736
##	732211.9	590693.1	524145.6	417491.6	518359.8	562795.3	373343.4
##	1737	1738	1739	1740	1741	1742	1743
##	472474.8	348840.8	369926.0	394982.5	1078230.4	634072.3	940738.7
##	1744	1745	1746	1747	1748	1749	1750
##	574691.8	491215.4	449798.0	593089.7	599736.3	429819.3	471823.2
##	1751	1752	1753	1754	1755	1756	1757
##	749651.4	394592.9	352309.7	507577.6	405672.1	267220.6	274561.1
##	1758	1759	1760	1761	1762	1763	1764
##	658033.6	336552.5	602709.4	532963.8	337319.9	483863.2	567708.2
##	1765	1766	1767	1768	1769	1770	1771
##	446705.1	393222.7	385798.8	528323.1	420588.5	509771.0	906427.6
##	1772	1773	1774	1775	1776	1777	1778
##	364919.4	332804.6	396433.5	314298.7	276570.9	380623.3	636414.6
##	1779	1780	1781	1782	1783	1784	1785
##	303354.5	457565.8	320218.2	389593.8	425407.1	421204.6	418463.7
##	1786	1787	1788	1789	1790	1791	1792
##	470744.6	454616.8	281459.3	633519.3	465948.5	421187.0	442100.6
##	1793	1794	1795	1796	1797	1798	1799
##	718676.0	361525.2	342843.8	371172.9	414396.2	434231.1	312160.4
##	1800	1801	1802	1803	1804	1805	1806
##	362268.6	267849.6	602853.9	770959.1	630510.5	585581.4	491406.7
##	1807	1808	1809	1810	1811	1812	1813
##	381440.6	329270.0	305620.5	306445.1	401533.9	424689.6	1059921.3
##	1814	1815	1816	1817	1818	1819	1820
##	819609.6	795980.8	597794.2	416768.6	399197.1	649594.9	650016.6
##	1821	1822	1823	1824	1825	1826	1827
##	478053.2	547686.6	318537.8	364673.8	432891.7	314454.1	417021.4
##	1828	1829	1830	1831	1832	1833	1834
##	300345.1	552167.7	870163.2	597719.5	576609.5	1065615.2	376400.7
##	1835	1836	1837	1838	1839	1840	1841
##	381815.0	373224.4	487148.0	429982.9	386566.2	305866.3	302575.9
##	1842	1843	1844	1845	1846	1847	1848
##	594894.4	920193.8	567978.4	730523.6	694623.5	534632.5	557671.0
##	1849	1850	1851	1852	1853	1854	1855
##	443046.1	466711.7	442959.4	352194.2	339880.1	438122.0	329917.8
##	1856	1857	1858	1859	1860	1861	1862
##	499823.1	425148.6	586171.2	596032.5	684923.0	495438.7	517824.6
##	1863	1864	1865	1866	1867	1868	1869
##	432392.5	430370.9	353622.3	332213.2	524561.0	397114.2	502019.7
##	1870	1871	1872	1873	1874	1875	1876
##	450308.9	302171.5	500153.3	449241.1	416402.6	327786.5	502056.4

##	1877	1878	1879	1880	1881	1882	1883
##	540810.6	718496.7	331521.6	875714.9	305804.1	455811.0	515609.1
##	1884	1885	1886	1887	1888	1889	1890
##	402078.1	370661.7	360030.8	627407.8	410347.3	413481.0	459381.5
##	1891	1892	1893	1894	1895	1896	1897
##	440749.7	356331.1	360851.6	306106.4	312495.6	342714.2	298431.2
##	1898	1899	1900	1901	1902	1903	1904
##	717777.3	940020.2	385247.2	867890.0	491956.9	451661.0	371838.0
##	1905	1906	1907	1908	1909	1910	1911
##	723288.7	400537.0	293651.8	530725.7	272721.1	386629.2	325827.2
##	1912	1913	1914	1915	1916	1917	1918
##	557005.6	366521.6	1464794.8	1042466.0	441720.0	665742.9	489199.2
##	1919	1920	1921	1922	1923	1924	1925
##	824740.6	562988.6	613674.1	637958.6	290338.3	399807.5	377501.1
##	1926	1927	1928	1929	1930	1931	1932
##	433211.5	450720.7	331971.6	372925.1	1419095.9	413767.5	394456.6
##	1933	1934	1935	1936	1937	1938	1939
##	822229.3	364293.6	576430.9	608308.1	328307.6	312370.3	504853.9
##	1940	1941	1942	1943	1944	1945	1946
##	345431.2	414396.2	284022.1	380052.3	289108.4	504820.5	464947.9
##	1947	1948	1949	1950	1951	1952	1953
##	454680.6	507446.8	290022.9	379171.5	378733.4	363686.8	534790.9
##	1954	1955	1956	1957	1958	1959	1960
##	328435.9	477488.3	364524.0	349715.7	536880.9	347243.8	1229359.7
##	1961	1962	1963	1964	1965	1966	1967
##	428218.1	438569.2	352756.9	380325.2	543873.2	336249.0	293681.1
##	1968	1969	1970	1971	1972	1973	1974
##	559330.2	485734.3	337993.7	398603.1	357725.6	470101.5	1971644.8
##	1975	1976	1977	1978	1979	1980	1981
##	770361.7	473726.1	619812.5	593835.7	351476.1	654092.3	341581.6
##	1982	1983	1984	1985	1986	1987	1988
##	569119.4	427448.9	427563.7	443247.6	326204.8	421741.1	472597.1
##	1989	1990	1991	1992	1993	1994	1995
##	287304.7	1601896.9	842584.3	607832.2	574687.3	555012.6	436930.4
##	1996	1997	1998	1999	2000	2001	2002
##	1798829.1	522306.8	501720.1	375569.7	530627.9	584484.4	436353.1
##	2003	2004	2005	2006	2007	2008	2009
##	549226.5	291708.2	331528.3	318574.9	357065.6	379747.6	895889.0
##	2010	2011	2012	2013	2014	2015	2016
##	599058.7	735655.6	417705.5	411457.9	597323.8	364539.2	355639.1
##	2017	2018	2019	2020	2021	2022	2023
##	524389.9	390969.5	454309.7	375125.4	452250.1	369377.0	354936.7
##	2024	2025	2026	2027	2028	2029	2030
##	417296.7	483710.0	383520.8	444659.2	456414.1	323315.7	1039757.4
##	2031	2032	2033	2034	2035	2036	2037
##	457357.2	494868.4	380775.2	460458.7	630682.3	488431.3	509508.6
##	2038	2039	2040	2041	2042	2043	2044
##	380729.9	303281.6	519208.8	510587.5	426059.6	358622.9	369546.2
##	2045	2046	2047	2048	2049	2050	2051
##	355965.0	329841.6	550260.7	1013476.6	633685.0	802399.3	543965.7
##	2052	2053	2054	2055	2056	2057	2058
##	395089.8	427839.6	484382.7	306106.4	649884.2	349200.9	411243.1
##	2059	2060	2061	2062	2063	2064	2065
##	432834.4	367367.3	422317.0	385536.1	564478.2	369154.1	342419.7



##	2066	2067	2068	2069	2070	2071	2072
##	476557.3	459971.1	807297.3	544715.7	377705.3	440458.9	677657.4
##	2073	2074	2075	2076	2077	2078	2079
##	507075.9	269250.9	672669.0	455060.2	432008.5	356985.4	293616.2
##	2080	2081	2082	2083	2084	2085	2086
##	372250.2	794706.9	647266.7	567990.1	322429.1	567380.4	389544.1
##	2087	2088	2089	2090	2091	2092	2093
##	531152.7	358126.0	414910.3	722366.4	340090.9	317440.5	299229.6
##	2094	2095	2096	2097	2098	2099	2100
##	298450.6	645035.8	573402.8	379136.0	522889.5	432434.8	325987.9
##	2101	2102	2103	2104	2105	2106	2107
##	328592.6	566592.0	294056.7	329462.8	301167.1	480987.5	307864.6
##	2108	2109	2110	2111	2112	2113	2114
##	781747.7	563295.5	862136.6	331683.7	543424.5	734291.7	375380.8
##	2115	2116	2117	2118	2119	2120	2121
##	425868.6	316350.8	507220.0	335557.3	273416.9	345544.7	642819.5
##	2122	2123	2124	2125	2126	2127	2128
##	355690.3	332295.4	289262.1	549145.4	573357.6	977521.4	771124.9
##	2129	2130	2131	2132	2133	2134	2135
##	522748.2	380379.2	602461.8	411532.4	350768.8	580786.2	316705.5
##	2136	2137	2138	2139	2140	2141	2142
##	436220.8	450247.8	392929.4	468849.2	289693.3	278148.5	397196.8
##	2143	2144	2145	2146	2147	2148	2149
##	566432.6	863680.8	626095.5	366399.9	1088563.5	451626.2	452765.6
##	2150	2151	2152	2153	2154	2155	2156
##	498766.0	420178.7	703879.6	374626.1	334793.3	571955.3	470025.0
##	2157	2158	2159	2160	2161	2162	2163
##	304429.8	287401.4	331554.0	440046.4	496794.6	336114.0	297591.2
##	2164	2165	2166	2167	2168	2169	2170
##	1053790.3	436271.7	346020.5	637529.2	439492.7	318081.4	503260.9
##	2171	2172	2173	2174	2175	2176	2177
##	444403.4	445484.5	317587.6	546717.0	280061.7	685974.1	644042.6
##	2178	2179	2180	2181	2182	2183	2184
##	470025.8	611456.2	374901.3	505423.6	340425.9	429546.7	506060.0
##	2185	2186	2187	2188	2189	2190	2191
##	466433.2	353968.2	300821.7	486817.8	566765.4	311304.4	363031.4
##	2192	2193	2194	2195	2196	2197	2198
##	401194.8	389880.9	349769.2	289165.5	310878.1	539465.4	705614.6
##	2199	2200	2201	2202	2203	2204	2205
##	484319.5	751451.2	576452.4	408131.0	345593.3	369701.2	362956.8
##	2206	2207	2208	2209	2210	2211	2212
##	320089.4	317430.1	623031.3	964428.0	700930.2	627420.8	801068.8
##	2213	2214	2215	2216	2217	2218	2219
##	417352.1	387499.9	357717.9	437931.8	299256.1	353415.5	587419.1
##	2220	2221	2222	2223	2224	2225	2226
##	418567.6	757320.6	310413.0	760786.0	355314.4	414505.1	371765.9
##	2227	2228	2229	2230	2231	2232	2233
##	274627.6	579156.3	652640.2	416325.1	328658.8	462848.8	486114.7
##	2234	2235	2236	2237	2238	2239	2240
##	288147.4	415116.3	375413.8	379514.0	379237.8	311121.6	331748.7
##	2241	2242	2243	2244	2245	2246	2247
##	504247.3	561849.9	1057456.5	357365.3	321964.2	365569.1	252880.7
##	2248	2249	2250	2251	2252	2253	2254
##	352492.4	402179.1	1115840.4	497117.5	1055138.1	1139628.9	1123727.3

##	2255	2256	2257	2258	2259	2260	2261
##	423840.8	644589.7	446380.3	414841.0	576372.9	412265.2	390868.8
##	2262	2263	2264	2265	2266	2267	2268
##	573825.4	563357.1	343071.6	532756.2	459245.9	449827.2	277244.1
##	2269	2270	2271	2272	2273	2274	2275
##	291999.5	857563.8	649649.6	595726.9	932624.2	698553.7	494486.8
##	2276	2277	2278	2279	2280	2281	2282
##	756860.0	859150.3	379538.1	720744.6	492897.4	513166.2	558821.4
##	2283	2284	2285	2286	2287	2288	2289
##	311474.3	523770.0	370352.6	414316.6	441509.8	507379.6	379599.8
##	2290	2291	2292	2293	2294	2295	2296
##	359652.1	380074.3	285722.3	401471.9	311334.3	1223996.8	1172908.6
##	2297	2298	2299	2300	2301	2302	2303
##	470407.5	422676.1	347680.8	552209.1	539282.2	460863.5	333322.7
##	2304	2305	2306	2307	2308	2309	2310
##	364529.0	511021.0	348658.1	350029.7	375654.8	338147.5	406857.9
##	2311	2312	2313	2314	2315	2316	2317
##	296588.6	419977.1	449266.7	1290583.7	1865343.3	825431.1	660940.3
##	2318	2319	2320	2321	2322	2323	2324
##	818107.0	577925.6	555272.3	485317.7	436731.9	365791.6	465628.3
##	2325	2326	2327	2328	2329	2330	2331
##	392182.5	338072.5	447596.0	573371.0	532704.3	656047.9	446671.1
##	2332	2333	2334	2335	2336	2337	2338
##	452609.3	337562.1	547986.0	564673.3	386285.0	447005.4	572849.7
##	2339	2340	2341	2342	2343	2344	2345
##	435263.2	600864.6	391724.8	496100.1	534515.6	392321.0	364083.9
##	2346	2347	2348	2349	2350	2351	2352
##	391794.3	396111.8	278256.9	295406.1	756957.1	509165.9	470342.6
##	2353	2354	2355	2356	2357	2358	2359
##	395440.6	723383.1	410351.1	549012.5	510998.3	400768.2	421133.0
##	2360	2361	2362	2363	2364	2365	2366
##	299891.9	376866.0	283929.9	449329.1	400766.3	306806.8	425995.2
##	2367	2368	2369	2370	2371	2372	2373
##	401717.3	295964.0	827207.1	459520.9	647946.5	398127.4	561153.8
##	2374	2375	2376	2377	2378	2379	2380
##	426651.5	401852.1	369649.4	330920.7	273452.6	891099.3	449140.5
##	2381	2382	2383	2384	2385	2386	2387
##	431979.5	488213.6	323188.5	360950.0	486142.0	294462.6	384645.7
##	2388	2389	2390	2391	2392	2393	2394
##	389079.7	511774.6	441806.5	473064.7	282629.8	389543.6	363394.3
##	2395	2396	2397	2398	2399	2400	2401
##	352631.7	431119.2	269268.5	352772.6	1143804.9	672727.1	398116.4
##	2402	2403	2404	2405	2406	2407	2408
##	322033.7	703818.5	778709.6	566218.2	513248.7	577424.9	332400.8
##	2409	2410	2411	2412	2413	2414	2415
##	357348.6	376504.1	504968.8	429325.7	354434.5	265290.3	411243.0
##	2416	2417	2418	2419	2420	2421	2422
##	556479.3	687285.2	2338457.9	772691.4	902912.0	602927.0	955560.1
##	2423	2424	2425	2426	2427	2428	2429
##	747612.6	688696.6	382084.2	467163.4	297457.5	355218.9	348508.5
##	2430	2431	2432	2433	2434	2435	2436
##	567898.8	329613.4	368696.7	405556.4	343447.0	317337.5	783915.3
##	2437	2438	2439	2440	2441	2442	2443
##	853862.8	389602.2	868051.5	701257.5	369501.2	395592.1	344328.1

##	2444	2445	2446	2447	2448	2449	2450
##	424108.4	347989.0	337232.5	298741.8	790180.6	411801.1	693058.5
##	2451	2452	2453	2454	2455	2456	2457
##	502607.9	692201.0	560638.2	445015.5	652610.2	542439.7	660289.4
##	2458	2459	2460	2461	2462	2463	2464
##	430180.1	278803.1	331507.0	450598.9	330834.3	324274.6	373714.5
##	2465	2466	2467	2468	2469	2470	2471
##	1035258.6	351999.5	542952.9	445480.4	485924.5	337511.1	283782.3
##	2472	2473	2474	2475	2476	2477	2478
##	340937.3	346073.8	394191.4	267867.0	417483.7	333010.4	282506.9
##	2479	2480	2481	2482	2483	2484	2485
##	316518.4	2164486.0	465623.8	805389.2	582250.4	436584.2	1305863.0
##	2486	2487	2488	2489	2490	2491	2492
##	393362.8	441314.2	463729.2	427810.2	318353.7	290470.9	653298.0
##	2493	2494	2495	2496	2497	2498	2499
##	446047.5	434193.4	289850.2	258502.0	306651.6	267454.7	1027549.9
##	2500	2501	2502	2503	2504	2505	2506
##	559077.0	781773.2	519435.8	410672.6	354245.4	507551.0	414651.7
##	2507	2508	2509	2510	2511	2512	2513
##	342081.5	303556.0	292107.7	265238.4	335065.0	268601.2	360753.9
##	2514	2515	2516	2517	2518	2519	2520
##	357229.5	364803.7	574162.5	512108.6	564249.7	393711.5	723532.7
##	2521	2522	2523	2524	2525	2526	2527
##	325857.8	379336.2	567264.7	428118.1	330818.0	330229.2	394537.6
##	2528	2529	2530	2531	2532	2533	2534
##	379180.5	281137.6	413551.4	344279.2	347532.4	717318.3	795544.4
##	2535	2536	2537	2538	2539	2540	2541
##	469951.6	471378.9	423914.0	309582.0	413790.5	370387.9	293865.4
##	2542	2543	2544	2545	2546	2547	2548
##	364263.7	429826.3	328215.1	518225.4	370734.6	346391.9	360195.8
##	2549	2550	2551	2552	2553	2554	2555
##	322390.1	341080.5	353101.0	281583.1	693329.9	760234.1	439302.1
##	2556	2557	2558	2559	2560	2561	2562
##	367486.8	423933.6	551675.9	354245.4	424338.3	571049.5	369453.7
##	2563	2564	2565	2566	2567	2568	2569
##	635629.4	642563.5	601945.8	347239.3	352952.9	303556.0	348257.6
##	2570	2571	2572	2573	2574	2575	2576
##	331705.4	762661.6	987872.4	368133.1	703805.4	371931.5	602855.0
##	2577	2578	2579	2580	2581	2582	2583
##	349974.0	336693.8	477929.3	358888.2	349116.7	325026.2	1828195.7
##	2584	2585	2586	2587	2588	2589	2590
##	517347.0	453666.0	464569.0	395827.6	342406.1	326527.6	462366.7
##	2591	2592	2593	2594	2595	2596	2597
##	466812.1	370907.2	607635.8	564825.1	552971.4	403949.6	361263.1
##	2598	2599	2600	2601	2602	2603	2604
##	323360.3	405352.9	402625.0	283723.1	287133.4	306926.4	455228.8
##	2605	2606	2607	2608	2609	2610	2611
##	627297.7	767150.7	435552.9	440596.6	327998.0	372036.3	347850.1
##	2612	2613	2614	2615	2616	2617	2618
##	474189.8	356470.2	271475.2	368444.8	704950.4	389074.5	440864.0
##	2619	2620	2621	2622	2623	2624	2625
##	381867.8	416904.8	339671.0	712303.4	286836.9	771007.0	995117.1
##	2626	2627	2628	2629	2630	2631	2632
##	330060.8	770698.0	749224.8	377554.5	625189.6	424172.8	700474.2

##	2633	2634	2635	2636	2637	2638	2639
##	362173.2	573969.7	401822.2	320750.9	321279.7	316261.4	277121.0
##	2640	2641	2642	2643	2644	2645	2646
##	443451.1	285752.4	297610.6	303856.0	434891.5	663529.0	455687.8
##	2647	2648	2649	2650	2651	2652	2653
##	551737.7	472397.7	763580.5	554748.4	687036.5	374567.6	372105.2
##	2654	2655	2656	2657	2658	2659	2660
##	369922.8	595538.9	468402.7	491742.4	344787.8	347616.1	518685.8
##	2661	2662	2663	2664	2665	2666	2667
##	392635.6	392091.3	280539.4	423892.2	389207.0	344462.4	855018.2
##	2668	2669	2670	2671	2672	2673	2674
##	730140.1	367027.8	366824.1	367566.2	557892.8	345166.5	433925.6
##	2675	2676	2677	2678	2679	2680	2681
##	391476.6	298486.8	605380.8	428646.6	381893.4	427016.8	379613.7
##	2682	2683	2684	2685	2686	2687	2688
##	426795.3	346441.8	419744.2	297648.9	858127.1	598109.4	483893.9
##	2689	2690	2691	2692	2693	2694	2695
##	557756.9	428730.5	411189.8	363149.9	1109925.5	706582.2	593367.3
##	2696	2697	2698	2699	2700	2701	2702
##	469954.7	524782.4	509941.2	383791.8	586822.0	510339.7	312810.5
##	2703	2704	2705	2706	2707	2708	2709
##	340109.8	365842.1	1692513.5	426488.5	914854.5	453757.4	922803.8
##	2710	2711	2712	2713	2714	2715	2716
##	673078.4	669595.8	521927.2	642430.3	505490.5	288297.3	347181.9
##	2717	2718	2719	2720	2721	2722	2723
##	570610.3	388029.0	299423.7	864882.3	604620.8	671196.3	440056.5
##	2724	2725	2726	2727	2728	2729	2730
##	573514.1	469718.4	290488.8	352470.0	318821.5	360551.4	516030.1
##	2731	2732	2733	2734	2735	2736	2737
##	428301.2	387667.2	443190.7	333353.8	311761.3	312485.4	475024.0
##	2738	2739	2740	2741	2742	2743	2744
##	450941.2	619651.0	367347.7	441347.1	318022.7	450101.0	426552.8
##	2745	2746	2747	2748	2749	2750	2751
##	399980.8	290473.6	382420.8	571081.2	714926.0	570078.5	408925.4
##	2752	2753	2754	2755	2756	2757	2758
##	375552.3	437698.2	930988.8	287039.2	309868.1	524058.7	347040.0
##	2759	2760	2761	2762	2763	2764	2765
##	442627.9	359890.9	4163191.1	955208.7	524014.6	296060.5	460090.2
##	2766	2767	2768	2769	2770	2771	2772
##	340582.6	539453.2	591205.3	394387.5	474001.7	299974.0	381558.5
##	2773	2774	2775	2776	2777	2778	2779
##	288601.2	298505.8	314881.8	281308.2	721267.5	479325.5	658521.8
##	2780	2781	2782	2783	2784	2785	2786
##	1353689.4	538786.5	427531.7	660681.3	617477.5	497334.3	387637.3
##	2787	2788	2789	2790	2791	2792	2793
##	448715.7	390638.5	563089.1	609449.8	371128.5	327340.4	337009.2
##	2794	2795	2796	2797	2798	2799	2800
##	398327.1	1559607.2	643316.3	579011.3	676782.8	599937.6	613458.2
##	2801	2802	2803	2804	2805	2806	2807
##	527287.1	607435.4	539629.2	439821.0	513544.6	348420.7	437527.6
##	2808	2809	2810	2811	2812	2813	2814
##	359765.4	494766.8	506884.2	401024.7	473218.2	602766.1	456584.2
##	2815	2816	2817	2818	2819	2820	2821
##	278350.8	416687.2	881971.0	505352.7	459077.6	682544.3	603004.6

```

##      2822      2823      2824      2825      2826      2827      2828
## 359866.2 401541.5 431288.8 469387.5 686300.2 401321.1 328329.2
##      2829      2830      2831      2832      2833      2834      2835
## 349627.8 349302.5 410189.8 488281.2 324541.5 514028.4 811722.9
##      2836      2837      2838      2839      2840      2841      2842
## 1125291.5 753767.3 345769.0 358581.0 464968.6 379040.6 415725.5
##      2843      2844      2845      2846      2847      2848      2849
## 455708.9 330032.5 469027.4 330572.1 465609.7 339367.9 439875.1
##      2850      2851      2852      2853      2854      2855      2856
## 420214.3 349837.2 374363.5 673610.7 725005.1 446457.6 362456.3
##      2857      2858      2859      2860      2861      2862      2863
## 343551.8 608427.2 632065.2 497939.0 322302.9 417906.0 290303.1
##      2864      2865      2866      2867      2868      2869      2870
## 667035.6 652520.2 579054.7 342803.0 512275.7 316412.6 1348457.5
##      2871      2872      2873      2874      2875      2876      2877
## 625182.7 1389900.9 332292.2 386834.8 402775.2 457594.8 362315.7
##      2878      2879      2880      2881      2882      2883      2884
## 502744.5 366183.9 304729.7 976145.9 661156.6 298233.7 717263.6
##      2885      2886      2887      2888      2889      2890      2891
## 613209.2 380399.5 340642.4 446199.6 371367.0 293807.9 512764.5
##      2892      2893      2894      2895      2896      2897      2898
## 666711.9 341285.4 353012.2 274868.9 272167.9 318581.3 313966.6
##      2899      2900      2901      2902      2903      2904      2905
## 489890.7 434914.3 418802.7 363547.8 501121.5 364045.7 396296.5
##      2906      2907      2908      2909      2910      2911      2912
## 411105.9 370363.0 267785.9 362696.4 556770.9 860298.8 432012.7
##      2913      2914      2915      2916      2917      2918      2919
## 567614.1 492972.6 581701.3 353600.1 386708.5 369293.6 388349.2
##      2920      2921      2922      2923      2924
## 423199.0 326807.3 461766.5 341822.3 398733.1

```

## Evaluate model

```

## create function
## create function to evaluate model

cal_mae <- function(actual, pred){
  error <- actual - pred
  mean(abs(error))
}

cal_mse <- function(actual, pred){
  error <- actual - pred
  mean(error ** 2)
}

cal_rmse <- function(actual, pred){
  error <- actual - pred
  sqrt(mean(error ** 2))
}

```

## Evaluate

```
## evaluate price_log  
cal_rmse(ts_log$price, p_log)
```

```
## [1] 0.3762722
```

```
cal_mse(ts_log$price, p_log)
```

```
## [1] 0.1415808
```

```
cal_mae(ts_log$price, p_log)
```

```
## [1] 0.3032386
```

```
## evaluate exp(log_price)
```

```
cal_rmse(ts_log$price, p)
```

```
## [1] 1077560
```

```
cal_mse(ts_log$price, p)
```

```
## [1] 1.161136e+12
```

```
cal_mae(ts_log$price, p)
```

```
## [1] 515956.6
```

## Summary

```
## finalModel
```

```
model$finalModel %>%  
summary()
```

```
##
```

```
## Call:
```

```
## lm(formula = .outcome ~ ., data = dat)
```

```
##
```

```
## Residuals:
```

```
##      Min       1Q   Median       3Q      Max  
## -1.64597 -0.27657  0.01668  0.24853  2.05277
```

```
##
```

```
## Coefficients:
```

```
##              Estimate Std. Error t value Pr(>|t|)  
## (Intercept)  1.227e+01  2.936e-02 417.760 < 2e-16 ***  
## distance_airport 6.525e-05  3.817e-04   0.171   0.864  
## no_bedrooms    -5.130e-02  4.433e-03 -11.572 < 2e-16 ***  
## no_bathrooms    5.070e-02  6.786e-03   7.470 8.56e-14 ***  
## no_schools     3.397e-03  4.174e-03   0.814   0.416  
## living_area    3.982e-04  5.907e-06  67.412 < 2e-16 ***
```

```
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
```

```
## Residual standard error: 0.3686 on 11690 degrees of freedom
```

```
## Multiple R-squared:  0.5077, Adjusted R-squared:  0.5074
```

```
## F-statistic: 2411 on 5 and 11690 DF, p-value: < 2.2e-16
```

```
## varImp
```

```
varImp(model)
```

```
## lm variable importance
```

```
##
```

```
## Overall
```

```
## living_area 100.0000
```

```
## no_bedrooms 16.9549
```

```
## no_bathrooms 10.8557
```

```
## no_schools 0.9561
```

```
## distance_airport 0.0000
```