

# Final Project Report

By Montanna Herdeman

## Project Background

Using devices such as Jawbone Up, Nike FuelBand, and Fitbit it is now possible to collect a large amount of data about personal activity relatively inexpensively. These type of devices are part of the quantified self movement - a group of enthusiasts who take measurements about themselves regularly to improve their health, to find patterns in their behavior, or because they are tech geeks. One thing that people regularly do is quantify how much of a particular activity they do, but they rarely quantify how well they do it. In this project, your goal will be to use data from accelerometers on the belt, forearm, arm, and dumbbell of 6 participants. They were asked to perform barbell lifts correctly and incorrectly in 5 different ways. More information is available from the website here:

<http://groupware.les.inf.puc-rio.br/har> (see the section on the Weight Lifting Exercise Dataset).

## Data

The training data for this project are available here:

<https://d396qusza40orc.cloudfront.net/predmachlearn/pml-training.csv>

The test data are available here:

<https://d396qusza40orc.cloudfront.net/predmachlearn/pml-testing.csv>

The data for this project come from this source: <http://groupware.les.inf.puc-rio.br/har>. If you use the document you create for this class for any purpose please cite them as they have been very generous in allowing their data to be used for this kind of assignment.

## Project Guidelines

The goal of your project is to predict the manner in which they did the exercise. This is the "classe" variable in the training set. You may use any of the other variables to predict with. You should create a report describing how you built your model, how you used cross validation, what you think the expected out of sample error is, and why you made the choices you did. You will also use your prediction model to predict 20 different test cases.

1. Your submission should consist of a link to a Github repo with your R markdown and compiled HTML file describing your analysis. Please constrain the text of the writeup to < 2000 words and the number of figures to be less than 5. It will make it easier for the graders if you submit a repo with a gh-pages branch so the HTML page can be viewed online (and you always want to make it easy on graders :-).
2. You should also apply your machine learning algorithm to the 20 test cases available in the test data above. Please submit your predictions in appropriate format to the

programming assignment for automated grading. See the programming assignment for additional details.

## Analysis

### Load appropriate packages and set seed

```
library(caret)
## Warning: package 'caret' was built under R version 3.1.3
## Loading required package: lattice
## Warning: package 'lattice' was built under R version 3.1.3
## Loading required package: ggplot2
## Warning: package 'ggplot2' was built under R version 3.1.3
library(rpart)
## Warning: package 'rpart' was built under R version 3.1.3
library(rpart.plot)
## Warning: package 'rpart.plot' was built under R version 3.1.3
library(RColorBrewer)
library(rattle)
## Warning: package 'rattle' was built under R version 3.1.3
## Rattle: A free graphical interface for data mining with R.
## Version 3.4.1 Copyright (c) 2006-2014 Togaware Pty Ltd.
## Type 'rattle()' to shake, rattle, and roll your data.
library(randomForest)
## Warning: package 'randomForest' was built under R version 3.1.3
## randomForest 4.6-10
## Type rfNews() to see new features/changes/bug fixes.
set.seed(1234)
```

### Load Data

```
trainUrl <- "http://d396qusza40orc.cloudfront.net/predmachlearn/pm1-
training.csv"
testUrl <- "http://d396qusza40orc.cloudfront.net/predmachlearn/pm1-
testing.csv"
training <- read.csv(url(trainUrl), na.strings=c("NA", "#DIV/0!", ""))
testing <- read.csv(url(testUrl), na.strings=c("NA", "#DIV/0!", ""))
```

## Clean Data

```
training <- training[,colSums(is.na(training)) == 0]
testing <- testing[,colSums(is.na(testing)) == 0]
training2 <- training[, -c(1:7)]
testing2 <- testing[, -c(1:7)]
```

## Separate training set into 2 subsets for testing and training

```
inTrain <- createDataPartition(y=training2$classe, p=0.75, list=FALSE)
myTraining <- training2[inTrain, ]; myTesting <- training2[-inTrain, ]
dim(myTraining); dim(myTesting)

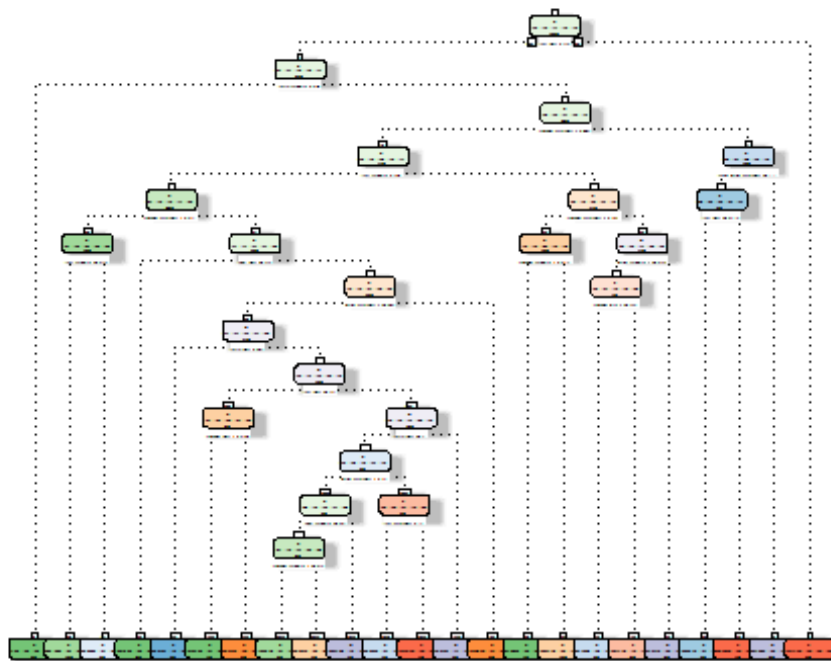
## [1] 14718    53
## [1] 4904     53
```

## Algorithms for prediction

### Decision Tree

```
modFit <- rpart(classe ~ ., data=myTraining, method="class")
fancyRpartPlot(modFit)
```

```
## Warning: labs do not fit even at cex 0.15, there may be some overplotting
```



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```
prediction1 <- predict(modFit, myTesting, type = "class")
confusionMatrix(prediction1, myTesting$classe)
```

```
## Confusion Matrix and Statistics
```

```
##
```

```
##           Reference
```

```
## Prediction    A    B    C    D    E
```

```
##           A 1235  157   16   50   20
```

```
##           B   55  568   73   80  102
```

```
##           C   44  125  690  118  116
```

```
##           D   41   64   50  508   38
```

```
##           E   20   35   26   48  625
```

```
##
```

```
## Overall Statistics
```

```
##
```

```
##           Accuracy : 0.7394
```

```
##           95% CI : (0.7269, 0.7516)
```

```
##           No Information Rate : 0.2845
```

```
##           P-Value [Acc > NIR] : < 2.2e-16
```

```
##
```

```
##           Kappa : 0.6697
```

```
##           McNemar's Test P-Value : < 2.2e-16
```

```
##
```

```
## Statistics by Class:
```

```
##
```

```
##           Class: A Class: B Class: C Class: D Class: E
```

```
## Sensitivity      0.8853   0.5985   0.8070   0.6318   0.6937
```

```
## Specificity      0.9307   0.9216   0.9005   0.9529   0.9678
```

```
## Pos Pred Value   0.8356   0.6469   0.6313   0.7247   0.8289
```

```
## Neg Pred Value   0.9533   0.9054   0.9567   0.9296   0.9335
```

```
## Prevalence       0.2845   0.1935   0.1743   0.1639   0.1837
```

```
## Detection Rate   0.2518   0.1158   0.1407   0.1036   0.1274
```

```
## Detection Prevalence 0.3014   0.1790   0.2229   0.1429   0.1538
```

```
## Balanced Accuracy 0.9080   0.7601   0.8537   0.7924   0.8307
```

Random Forest

```
modFit2 <- randomForest(classe ~. , data=myTraining)
```

```
prediction2 <- predict(modFit2, myTesting)
```

```
confusionMatrix(prediction2, myTesting$classe)
```

```
## Confusion Matrix and Statistics
```

```
##
```

```
##           Reference
```

```
## Prediction    A    B    C    D    E
```

```
##           A 1394     3     0     0     0
```

```
##           B     1  944    10     0     0
```

```
##           C     0     2  843     6     0
```

```
##           D     0     0     2  798     0
```

```
##           E     0     0     0     0  901
```

```
##
```

```
## Overall Statistics
```

```
##
```

```
##           Accuracy : 0.9951
```

```
##          95% CI : (0.9927, 0.9969)
##      No Information Rate : 0.2845
##      P-Value [Acc > NIR] : < 2.2e-16
##
##          Kappa : 0.9938
##  Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##          Class: A Class: B Class: C Class: D Class: E
## Sensitivity      0.9993   0.9947   0.9860   0.9925   1.0000
## Specificity      0.9991   0.9972   0.9980   0.9995   1.0000
## Pos Pred Value   0.9979   0.9885   0.9906   0.9975   1.0000
## Neg Pred Value    0.9997   0.9987   0.9970   0.9985   1.0000
## Prevalence       0.2845   0.1935   0.1743   0.1639   0.1837
## Detection Rate    0.2843   0.1925   0.1719   0.1627   0.1837
## Detection Prevalence 0.2849   0.1947   0.1735   0.1631   0.1837
## Balanced Accuracy 0.9992   0.9960   0.9920   0.9960   1.0000
```

## Submission

```
finalpredict <- predict(modFit2, myTesting, type="class")
finalpredict
```

[illegible]

##	637	640	641	646	647	648	650	651	655	656	659	660
##	A	A	A	A	A	A	A	A	A	A	A	A
##	662	667	671	673	674	682	700	703	706	717	720	739
##	A	A	A	A	A	A	A	A	A	A	A	A
##	747	755	761	771	776	778	779	782	789	792	803	808
##	A	A	A	A	A	A	A	A	A	A	A	A
##	816	819	820	825	827	834	836	837	843	847	852	856
##	A	A	A	A	A	A	A	A	A	A	A	A
##	857	863	878	886	889	891	893	901	904	905	915	918
##	A	A	A	A	A	A	A	A	A	A	A	A
##	920	922	924	926	927	936	939	940	942	946	947	951
##	A	A	A	A	A	A	A	A	A	A	A	A
##	952	953	955	962	963	966	968	969	971	981	993	999
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1001	1002	1008	1022	1025	1033	1041	1042	1048	1060	1062	1066
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1067	1068	1072	1074	1080	1082	1083	1086	1089	1093	1094	1101
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1102	1107	1110	1114	1115	1123	1134	1142	1145	1151	1170	1174
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1178	1180	1181	1190	1196	1198	1199	1205	1206	1209	1211	1217
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1222	1230	1234	1237	1238	1239	1240	1243	1244	1248	1251	1252
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1253	1257	1258	1259	1261	1263	1269	1277	1278	1288	1289	1298
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1303	1308	1310	1313	1320	1321	1322	1324	1326	1329	1332	1335
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1337	1344	1355	1358	1366	1367	1369	1374	1375	1376	1378	1385
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1393	1404	1407	1412	1416	1418	1424	1427	1429	1430	1440	1445
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1447	1450	1453	1454	1465	1466	1469	1470	1476	1497	1502	1505
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1507	1511	1513	1514	1525	1532	1537	1549	1552	1554	1555	1563
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1573	1581	1589	1592	1597	1616	1627	1631	1633	1634	1635	1638
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1648	1652	1653	1658	1659	1661	1664	1666	1670	1671	1672	1678
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1693	1694	1695	1697	1700	1704	1710	1712	1714	1726	1729	1731
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1737	1742	1744	1745	1750	1753	1754	1758	1764	1766	1776	1795
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1798	1799	1804	1808</								

##	1945	1947	1952	1954	1969	1973	1974	1978	1981	1987	1991	1992
##	A	A	A	A	A	A	A	A	A	A	A	A
##	1995	2000	2005	2007	2012	2017	2023	2028	2043	2044	2046	2049
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2053	2054	2064	2065	2068	2071	2076	2078	2081	2083	2087	2088
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2090	2091	2111	2118	2119	2120	2121	2123	2125	2127	2128	2136
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2139	2141	2149	2155	2156	2159	2161	2164	2174	2182	2183	2184
##	A	A	A	A	A	A	A	A	A	A	A	B
##	2186	2187	2191	2193	2197	2200	2205	2210	2214	2229	2231	2234
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2245	2250	2252	2255	2257	2266	2271	2276	2278	2280	2282	2285
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2287	2290	2296	2298	2302	2303	2304	2306	2314	2332	2335	2336
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2337	2340	2342	2348	2350	2351	2355	2360	2370	2373	2377	2378
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2383	2392	2396	2397	2400	2401	2405	2406	2407	2410	2411	2415
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2424	2426	2428	2429	2430	2434	2447	2452	2454	2460	2467	2469
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2470	2473	2477	2481	2483	2485	2486	2488	2493	2495	2496	2499
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2501	2503	2504	2508	2511	2513	2514	2515	2528	2534	2535	2540
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2549	2550	2553	2554	2555	2557	2560	2564	2577	2582	2583	2584
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2592	2597	2598	2599	2600	2604	2606	2607	2625	2628	2629	2632
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2634	2638	2639	2644	2647	2651	2654	2656	2658	2664	2678	2681
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2685	2693	2696	2699	2700	2702	2703	2704	2706	2709	2717	2719
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2727	2733	2737	2739	2741	2743	2744	2748	2749	2751	2756	2760
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2761	2764	2773	2775	2777	2783	2786	2791	2794	2796	2798	2800
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2806	2818	2827	2828	2829	2831	2833	2834	2840	2848	2853	2855
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2856	2871	2873	2878	2881	2883	2887	2894	2898	2900	2901	2905
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2908	2910	2916	2923	2928	2930	2932	2936	2938	2944	2945	2950
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2951	2952	2954	2955	2960	2968	2972	2982	2984	2985	2988	2994
##	A	A	A	A	A	A	A	A	A	A	A	A
##	2995	3000	3013	3017	3021	3022	3025	3027	3036	3043	3050	3052
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3057	3064	3065	3085	3092	3094	3102	3110	3114	3117	3118	3119
##	A	A	A	A	A	A	A	A	A	A	A	A

##	3120	3126	3127	3128	3130	3131	3134	3137	3139	3142	3146	3147
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3152	3163	3172	3173	3178	3183	3184	3185	3194	3195	3198	3201
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3203	3213	3215	3221	3223	3226	3230	3232	3235	3244	3250	3251
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3255	3256	3260	3264	3269	3272	3273	3277	3280	3281	3282	3287
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3289	3290	3295	3303	3308	3310	3316	3320	3321	3323	3325	3326
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3327	3330	3331	3334	3337	3340	3341	3343	3345	3348	3351	3352
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3355	3378	3380	3382	3383	3387	3406	3409	3415	3416	3427	3431
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3433	3434	3437	3439	3441	3455	3463	3464	3471	3474	3484	3485
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3487	3490	3493	3498	3499	3504	3505	3509	3510	3513	3519	3531
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3532	3542	3543	3549	3550	3551	3554	3558	3563	3566	3572	3579
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3582	3591	3597	3598	3599	3600	3602	3604	3605	3608	3609	3613
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3624	3627	3628	3633	3644	3646	3649	3650	3655	3656	3657	3658
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3659	3661	3662	3664	3667	3669	3676	3680	3681	3686	3688	3689
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3690	3699	3701	3702	3703	3709	3710	3713	3720	3721	3724	3725
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3729	3730	3733	3734	3735	3740	3742	3744	3745	3752	3754	3763
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3766	3768	3773	3775	3776	3781	3785	3790	3793	3801	3807	3808
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3810	3819	3821	3827	3829	3839	3843	3844	3848	3852	3855	3856
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3865	3867	3875	3879	3887	3889	3891	3892	3898	3901	3909	3911
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3918	3921	3923	3925	3926	3929	3933	3936	3939	3940	3941	3949
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3950	3954	3956	3962	3963	3967	3974	3978	3979	3982	3985	3986
##	A	A	A	A	A	A	A	A	A	A	A	A
##	3993	3994	3998	3999	4000	4003	4007	4008	4010	4014	4016	4018
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4022	4023	4026	4031	4039	4046	4048	4054	4061	4065	4072	4076
##	A	A	A	A								



##	4235	4237	4238	4244	4245	4250	4255	4257	4260	4261	4272	4278
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4279	4283	4285	4296	4297	4300	4301	4302	4304	4312	4322	4323
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4331	4332	4333	4336	4337	4338	4340	4347	4357	4361	4380	4383
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4385	4392	4397	4398	4399	4400	4401	4409	4413	4417	4418	4425
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4428	4431	4432	4436	4439	4441	4447	4448	4452	4454	4455	4458
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4465	4467	4470	4471	4472	4478	4482	4488	4489	4492	4493	4498
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4499	4501	4508	4510	4513	4514	4518	4526	4528	4530	4532	4543
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4553	4554	4555	4557	4560	4563	4565	4566	4573	4576	4578	4579
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4580	4588	4589	4592	4597	4598	4602	4604	4609	4613	4614	4618
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4622	4623	4624	4625	4630	4631	4634	4643	4645	4646	4651	4652
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4653	4663	4665	4666	4669	4677	4682	4701	4706	4708	4710	4713
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4717	4720	4724	4727	4731	4737	4739	4742	4744	4754	4763	4764
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4766	4768	4770	4772	4773	4779	4788	4791	4793	4797	4798	4807
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4809	4810	4812	4816	4822	4828	4835	4840	4845	4846	4848	4850
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4854	4857	4865	4868	4873	4883	4887	4899	4905	4911	4912	4913
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4914	4915	4916	4918	4934	4937	4941	4942	4944	4952	4953	4958
##	A	A	A	A	A	A	A	A	A	A	A	A
##	4962	4967	4969	4972	4974	5008	5012	5014	5015	5016	5020	5023
##	A	A	A	A	A	A	A	A	A	A	A	A
##	5025	5026	5028	5031	5037	5038	5039	5041	5047	5051	5054	5062
##	A	A	A	A	A	A	A	A	A	A	A	A
##	5065	5070	5076	5082	5084	5086	5089	5095	5098	5101	5104	5108
##	A	A	A	A	A	A	A	A	A	A	A	A
##	5112	5116	5117	5121	5125	5129	5130	5132	5135	5136	5138	5139
##	A	A	A	A	A	A	A	A	A	A	A	A
##	5146	5149	5154	5164	5170	5173	5175	5178	5188	5193	5194	5200
##	A	A	A	A	A	A	A	A	A	A	A	A
##	5201	5202	5206	5207	5211	5214	5244	5249	5251	5254	5256	5257
##	A	A	A	A								

##	5415	5425	5428	5432	5436	5444	5446	5447	5453	5455	5456	5459
##	A	A	A	A	A	A	A	A	A	A	A	A
##	5465	5476	5486	5489	5490	5494	5503	5512	5514	5516	5523	5527
##	A	A	A	A	A	A	A	A	A	A	A	A
##	5528	5534	5538	5540	5542	5548	5553	5554	5556	5558	5561	5564
##	A	A	A	A	A	A	A	A	A	A	A	A
##	5572	5576	5577	5581	5585	5587	5594	5595	5603	5605	5613	5623
##	A	A	A	A	B	B	B	B	B	B	B	B
##	5628	5631	5634	5637	5644	5646	5647	5648	5654	5656	5657	5658
##	B	B	B	B	B	B	B	A	B	B	B	B
##	5674	5676	5678	5685	5687	5692	5696	5697	5704	5705	5710	5711
##	B	B	B	B	B	B	B	B	B	B	B	B
##	5717	5720	5725	5726	5731	5733	5734	5742	5743	5748	5750	5751
##	B	B	B	B	B	B	B	B	B	B	B	B
##	5760	5762	5766	5768	5774	5778	5782	5783	5785	5786	5787	5789
##	B	B	B	B	B	B	B	B	B	B	B	B
##	5794	5802	5803	5806	5809	5811	5822	5828	5830	5833	5835	5836
##	B	B	B	B	B	B	B	B	B	B	B	B
##	5846	5850	5854	5857	5864	5870	5873	5876	5877	5883	5884	5891
##	B	B	B	B	B	B	B	B	B	B	B	B
##	5893	5901	5905	5906	5907	5914	5921	5925	5926	5927	5931	5935
##	B	B	B	B	B	B	B	B	B	B	B	B
##	5938	5940	5941	5954	5955	5962	5971	5972	5973	5984	5993	5996
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6003	6005	6006	6007	6009	6012	6013	6014	6019	6025	6030	6033
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6035	6046	6047	6054	6058	6060	6061	6067	6072	6074	6075	6081
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6084	6085	6086	6089	6101	6105	6111	6124	6125	6128	6137	6147
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6157	6159	6162	6164	6167	6168	6176	6178	6187	6192	6193	6195
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6200	6201	6203	6204	6205	6217	6230	6232	6237	6242	6252	6253
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6254	6264	6265	6266	6270	6275	6276	6282	6283	6284	6285	6286
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6295	6306	6314	6324	6329	6330	6331	6335	6336	6340	6349	6351
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6352	6355	6356	6357	6367	6391	6393	6398	6400	6406	6408	6417
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6419	6428	6429	6438	6439	6442	6444	6446	6447	6448	6449	6452
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6457	6458	6462	6463	6466	6474	6483	6484	6485	6486	6487	6489
##	B	B	B	B								

##	6635	6636	6648	6651	6653	6657	6659	6660	6661	6667	6673	6677
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6682	6684	6686	6687	6695	6699	6700	6701	6708	6711	6724	6726
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6727	6740	6744	6751	6755	6760	6761	6766	6779	6780	6781	6782
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6787	6789	6793	6795	6797	6803	6810	6811	6814	6816	6817	6824
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6827	6838	6842	6843	6855	6867	6869	6872	6875	6877	6880	6882
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6883	6884	6886	6888	6891	6895	6899	6912	6917	6924	6930	6931
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6933	6936	6937	6940	6947	6951	6960	6961	6962	6963	6965	6966
##	B	B	B	B	B	B	B	B	B	B	B	B
##	6969	6970	6975	6992	6994	6997	7005	7010	7012	7014	7016	7018
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7024	7028	7030	7032	7033	7037	7042	7046	7054	7055	7057	7064
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7067	7069	7073	7082	7084	7086	7088	7089	7099	7104	7108	7111
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7114	7122	7133	7138	7152	7153	7154	7160	7164	7165	7174	7183
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7184	7185	7189	7192	7197	7200	7202	7206	7209	7211	7213	7224
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7229	7232	7238	7242	7251	7255	7260	7262	7270	7276	7287	7301
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7303	7305	7310	7325	7331	7332	7334	7336	7338	7339	7342	7343
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7345	7346	7347	7355	7358	7360	7365	7367	7377	7381	7382	7383
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7384	7391	7396	7399	7403	7407	7414	7417	7420	7430	7431	7435
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7436	7437	7439	7443	7447	7448	7449	7466	7470	7478	7482	7488
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7501	7505	7506	7508	7510	7514	7519	7520	7521	7525	7531	7535
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7541	7549	7550	7555	7562	7583	7584	7586	7588	7594	7595	7600
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7604	7605	7606	7607	7610	7612	7613	7614	7615	7617	7618	7627
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7632	7637	7639	7645	7646	7650	7653	7657	7665	7666	7670	7674
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7677	7678	7679	7688	7694	7696	7698	7706	7709	7711	7715	7719
##	B	B	B	B								

##	7880	7888	7889	7890	7891	7894	7897	7898	7899	7905	7906	7912
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7915	7925	7931	7933	7935	7939	7942	7944	7945	7947	7948	7951
##	B	B	B	B	B	B	B	B	B	B	B	B
##	7953	7959	7964	7966	7978	7981	7985	7988	7992	7993	7995	7997
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8014	8017	8018	8020	8021	8024	8028	8031	8043	8046	8048	8057
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8060	8063	8070	8073	8074	8081	8083	8086	8090	8095	8096	8099
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8105	8108	8109	8111	8114	8120	8124	8125	8129	8131	8133	8134
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8135	8139	8140	8143	8144	8147	8159	8169	8170	8172	8176	8182
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8185	8190	8197	8202	8203	8206	8212	8213	8215	8216	8220	8221
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8230	8233	8237	8240	8245	8250	8253	8255	8259	8261	8268	8275
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8277	8279	8280	8285	8288	8289	8297	8302	8312	8313	8315	8319
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8320	8322	8329	8334	8336	8337	8339	8342	8343	8345	8352	8355
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8366	8369	8371	8373	8376	8377	8379	8380	8381	8385	8386	8390
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8395	8396	8399	8400	8401	8403	8407	8410	8416	8417	8420	8430
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8436	8440	8442	8443	8445	8448	8449	8456	8458	8462	8464	8467
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8469	8470	8478	8482	8490	8497	8498	8499	8501	8504	8508	8510
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8514	8516	8518	8519	8522	8524	8526	8528	8530	8543	8553	8557
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8558	8567	8568	8569	8575	8580	8581	8586	8593	8596	8598	8599
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8602	8603	8607	8616	8623	8624	8626	8630	8638	8640	8643	8644
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8648	8649	8652	8656	8659	8662	8676	8677	8683	8684	8688	8689
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8690	8692	8703	8705	8710	8714	8716	8717	8723	8724	8725	8729
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8731	8734	8742	8746	8747	8750	8756	8760	8762	8763	8765	8767
##	B	B	B	B	B	B	B	B	B	B	B	B
##	8768	8772	8777	8780	8792	8796	8799	8804	8805	8806	8812	8822
##	B	B	B	B								

##	9032	9033	9035	9039	9048	9049	9052	9057	9063	9067	9073	9075
##	B	B	B	B	B	B	B	B	B	B	B	B
##	9076	9079	9080	9090	9095	9097	9103	9106	9108	9109	9110	9114
##	B	B	B	B	B	B	B	B	B	B	B	B
##	9116	9117	9119	9129	9131	9137	9143	9146	9147	9151	9152	9157
##	B	B	B	B	B	B	B	B	B	B	B	B
##	9159	9161	9163	9177	9180	9181	9183	9187	9192	9196	9210	9211
##	B	B	B	B	B	B	B	B	B	B	B	B
##	9215	9221	9222	9227	9229	9234	9236	9237	9240	9243	9252	9258
##	B	B	B	B	B	B	B	B	B	B	B	B
##	9260	9263	9268	9277	9278	9280	9282	9284	9291	9296	9299	9310
##	B	B	B	B	B	B	B	B	B	B	B	B
##	9322	9323	9324	9333	9334	9336	9341	9350	9354	9355	9357	9359
##	B	B	B	B	B	B	B	B	B	B	B	B
##	9361	9372	9374	9375	9378	9385	9391	9400	9402	9403	9404	9405
##	B	B	B	B	C	C	C	C	B	B	B	B
##	9406	9414	9420	9426	9433	9436	9442	9445	9458	9472	9495	9498
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9501	9508	9512	9513	9516	9517	9518	9523	9535	9537	9540	9541
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9543	9544	9548	9550	9551	9553	9558	9559	9560	9564	9566	9567
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9573	9578	9584	9585	9588	9591	9593	9594	9595	9596	9599	9608
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9613	9622	9623	9629	9631	9633	9638	9641	9648	9653	9660	9662
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9665	9668	9672	9673	9677	9678	9680	9682	9683	9684	9686	9687
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9690	9700	9707	9711	9717	9718	9725	9728	9732	9734	9735	9741
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9749	9752	9756	9758	9762	9763	9770	9777	9782	9784	9787	9791
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9796	9811	9813	9815	9818	9827	9836	9839	9842	9843	9846	9860
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9861	9867	9879	9880	9883	9884	9885	9888	9893	9894	9899	9900
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9901	9903	9907	9912	9917	9920	9923	9925	9926	9929	9930	9932
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9939	9940	9941	9942	9946	9947	9948	9949	9951	9954	9959	9976
##	C	C	C	C	C	C	C	C	C	C	C	C
##	9983	9988	9993	9997	9998	10000	10001	10012	10014	10017	10028	10031
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10032	10033	10038	10049	10050	10053	10054	10055	10056	10060	10065	10070
##												

##	10182	10197	10200	10203	10210	10211	10213	10214	10218	10220	10222	10235
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10236	10238	10243	10247	10255	10257	10258	10265	10282	10283	10286	10288
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10292	10293	10305	10310	10312	10323	10327	10333	10339	10346	10352	10358
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10368	10369	10375	10378	10381	10383	10385	10387	10388	10389	10396	10398
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10400	10402	10408	10412	10422	10426	10430	10436	10442	10444	10449	10453
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10459	10462	10467	10469	10472	10473	10476	10478	10482	10486	10487	10490
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10494	10504	10507	10510	10513	10515	10517	10523	10534	10535	10537	10543
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10545	10547	10554	10569	10574	10578	10581	10584	10586	10591	10594	10595
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10600	10603	10608	10610	10613	10614	10615	10616	10618	10619	10627	10628
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10630	10646	10647	10648	10653	10656	10658	10663	10667	10675	10676	10677
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10679	10680	10681	10689	10693	10695	10713	10715	10719	10724	10730	10737
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10741	10742	10745	10746	10748	10752	10771	10775	10777	10778	10782	10790
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10796	10804	10805	10810	10811	10812	10813	10819	10820	10824	10825	10828
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10835	10840	10844	10846	10858	10860	10873	10874	10880	10883	10887	10890
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10891	10892	10895	10901	10903	10905	10910	10911	10918	10919	10920	10923
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10926	10927	10928	10934	10936	10944	10948	10950	10952	10953	10955	10958
##	C	C	C	C	C	C	C	C	C	C	C	C
##	10965	10969	10976	10978	10983	10988	10993	10998	10999	11003	11006	11014
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11015	11021	11022	11024	11028	11030	11033	11034	11035	11036	11048	11052
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11053	11055	11056	11071	11079	11086	11087	11088	11107	11112	11117	11122
##	C	D	C	C	C	C	C	C	C	C	C	C
##	11123	11128	11140	11144	11147	11149	11152	11153	11158	11159	11161	11165
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11169	11170	11178	11183	11184	11187	11189	11192	1119			

##	11411	11412	11414	11426	11434	11435	11436	11441	11446	11448	11452	11456
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11457	11462	11463	11469	11471	11474	11477	11480	11487	11490	11492	11498
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11505	11508	11510	11515	11517	11519	11523	11525	11533	11540	11542	11543
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11554	11556	11568	11571	11574	11577	11580	11582	11584	11591	11592	11599
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11601	11602	11612	11615	11616	11623	11624	11627	11634	11638	11641	11642
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11644	11645	11652	11655	11657	11660	11674	11680	11689	11690	11696	11701
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11714	11720	11722	11723	11725	11726	11734	11738	11740	11744	11748	11760
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11763	11768	11770	11771	11772	11773	11775	11777	11782	11786	11792	11799
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11801	11802	11804	11806	11811	11823	11825	11833	11838	11841	11845	11846
##	C	C	C	C	C	D	C	C	C	C	C	C
##	11848	11851	11852	11853	11855	11861	11865	11869	11870	11871	11872	11876
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11878	11879	11881	11883	11884	11886	11887	11888	11890	11892	11898	11900
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11907	11908	11909	11914	11925	11930	11933	11934	11937	11938	11939	11941
##	C	C	C	C	C	C	C	C	C	C	C	C
##	11942	11945	11946	11960	11965	11968	11969	11971	11998	12001	12003	12006
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12010	12012	12016	12017	12018	12023	12024	12026	12028	12030	12031	12034
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12036	12041	12047	12062	12063	12065	12069	12073	12074	12076	12078	12085
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12088	12094	12097	12099	12102	12104	12106	12108	12111	12113	12115	12117
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12121	12126	12132	12139	12141	12143	12144	12147	12153	12155	12158	12170
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12173	12174	12181	12184	12195	12197	12198	12201	12203	12210	12219	12223
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12224	12233	12239	12242	12247	12248	12256	12257	12258	12265	12269	12270
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12278	12280	12283	12286	12288	12290	12297	12299	12320	12321	12322	12331
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12339	12341	12345	12351	12363	12370	12375	12376	1237			

##	12589	12590	12599	12601	12624	12630	12632	12645	12650	12653	12662	12664
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12667	12672	12683	12684	12699	12702	12708	12710	12714	12715	12716	12728
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12731	12734	12736	12737	12739	12740	12748	12754	12755	12758	12766	12773
##	C	C	C	C	C	C	C	C	C	C	C	C
##	12775	12781	12784	12789	12791	12793	12799	12800	12807	12809	12810	12813
##	C	C	C	C	C	C	C	D	D	D	D	D
##	12815	12816	12818	12819	12820	12821	12823	12825	12826	12827	12831	12833
##	D	D	D	D	D	D	D	D	D	D	D	D
##	12835	12837	12839	12843	12845	12852	12854	12856	12859	12862	12865	12867
##	D	D	D	D	D	D	D	D	D	D	D	D
##	12871	12872	12881	12883	12885	12886	12887	12893	12894	12897	12900	12903
##	D	D	D	D	D	D	D	D	D	D	D	D
##	12905	12910	12923	12925	12940	12942	12947	12950	12960	12965	12969	12970
##	D	D	D	D	D	D	D	D	D	C	C	C
##	12971	12972	12976	12980	12984	12989	12993	12997	12998	13006	13007	13008
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13011	13016	13019	13020	13024	13034	13046	13049	13053	13054	13059	13060
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13066	13068	13073	13075	13077	13080	13081	13082	13084	13086	13095	13096
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13099	13110	13112	13117	13120	13124	13134	13138	13144	13145	13146	13147
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13148	13153	13154	13159	13162	13163	13165	13178	13185	13189	13201	13206
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13207	13208	13213	13219	13220	13228	13232	13234	13239	13246	13247	13255
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13257	13264	13265	13266	13271	13272	13274	13275	13287	13288	13289	13290
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13291	13295	13297	13298	13301	13303	13304	13308	13315	13325	13328	13329
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13331	13336	13337	13343	13348	13350	13351	13352	13353	13357	13369	13373
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13374	13380	13384	13390	13393	13395	13396	13399	13403	13404	13405	13406
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13407	13415	13417	13425	13434	13437	13443	13446	13450	13451	13461	13463
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13464	13467	13469	13475	13483	13485	13486	13488	13502	13512	13513	13515
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13523	13527	13528	13530	13533	13541	13544	13547	1355			



##	13777	13788	13790	13800	13802	13808	13816	13817	13819	13821	13822	13825
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13828	13831	13838	13843	13844	13845	13848	13849	13850	13854	13856	13857
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13861	13868	13872	13873	13876	13877	13878	13879	13883	13892	13896	13902
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13903	13912	13914	13917	13920	13922	13928	13931	13933	13949	13954	13955
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13956	13960	13961	13962	13964	13965	13967	13970	13975	13984	13986	13990
##	D	D	D	D	D	D	D	D	D	D	D	D
##	13997	14000	14002	14003	14004	14012	14017	14019	14025	14031	14037	14039
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14053	14058	14060	14062	14070	14074	14075	14083	14084	14086	14090	14091
##	D	D	D	D	D	D	D	D	D	D	C	C
##	14092	14094	14103	14104	14106	14110	14111	14113	14114	14115	14116	14117
##	D	C	D	D	D	D	D	D	D	D	D	D
##	14118	14128	14130	14132	14137	14141	14152	14158	14166	14168	14169	14170
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14171	14181	14182	14189	14192	14193	14199	14206	14211	14212	14217	14219
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14232	14237	14238	14244	14245	14246	14247	14252	14253	14256	14258	14262
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14264	14265	14270	14271	14272	14274	14276	14281	14285	14286	14287	14288
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14292	14296	14302	14303	14307	14313	14314	14316	14317	14320	14325	14329
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14334	14338	14339	14340	14343	14351	14354	14355	14361	14362	14368	14369
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14379	14380	14381	14385	14386	14394	14397	14398	14404	14405	14411	14415
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14420	14421	14432	14435	14438	14439	14443	14446	14447	14454	14461	14465
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14467	14468	14474	14480	14482	14486	14491	14492	14506	14508	14510	14512
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14518	14524	14526	14528	14532	14538	14539	14548	14553	14556	14567	14576
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14583	14585	14587	14592	14593	14595	14598	14601	14605	14607	14624	14627
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14628	14634	14636	14637	14640	14645	14646	14652	14660	14664	14666	14668
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14670	14673	14675	14687	14692	14693	14698	14705	1471			

##	14908	14925	14927	14933	14935	14940	14943	14949	14951	14958	14959	14967
##	D	D	D	D	D	D	D	D	D	D	D	D
##	14974	14975	14978	14982	14988	14989	15000	15003	15010	15015	15018	15022
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15026	15031	15034	15046	15054	15080	15090	15093	15100	15105	15106	15111
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15116	15123	15128	15131	15133	15134	15136	15138	15140	15145	15151	15160
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##	15161	15162	15166	15169	15176	15183	15185	15187	15191	15200	15202	15204
##	D	D	D	D	D	D	D	D	D	D	D	D
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##	D	D	D	D	D	D	D	D	D	D	D	D
##	15268	15271	15272	15276	15278	15287	15300	15305	15307	15309	15329	15330
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15331	15339	15340	15341	15345	15347	15356	15359	15360	15361	15365	15367
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15373	15375	15380	15382	15388	15403	15404	15406	15407	15408	15410	15414
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15425	15428	15431	15433	15434	15435	15442	15447	15453	15454	15462	15466
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15467	15473	15475	15477	15478	15493	15499	15502	15509	15512	15522	15524
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15525	15528	15529	15531	15534	15540	15541	15549	15551	15559	15562	15565
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15568	15571	15575	15576	15583	15585	15586	15589	15592	15593	15600	15602
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15603	15607	15613	15624	15626	15629	15636	15646	15648	15655	15657	15660
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15664	15669	15673	15680	15681	15683	15684	15696	15701	15703	15705	15713
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15723	15730	15731	15735	15736	15737	15738	15742	15743	15753	15757	15763
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15764	15765	15767	15779	15780	15787	15791	15792	15793	15798	15803	15809
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15812	15827	15828	15829	15835	15843	15847	15849	15850	15857	15859	15860
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15862	15864	15876	15879	15890	15893	15897	15902	15908	15912	15913	15918
##	D	D	D	D	D	D	D	D	D	D	D	D
##	15924	15941	15949	15950	15951	15955	15959	15965	15966	15967	15982	15985
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##	15989	15990	15991	15996	15998	16006	16009	16016	1601			

##	16212	16213	16217	16222	16227	16230	16232	16236	16241	16242	16251	16255
##	E	E	E	E	E	E	E	E	E	E	E	E
##	16258	16260	16273	16276	16278	16280	16281	16283	16285	16287	16289	16292
##	E	E	E	E	E	E	E	E	E	E	E	E
##	16295	16297	16300	16302	16304	16308	16316	16317	16318	16319	16320	16325
##	E	E	E	E	E	E	E	E	E	E	E	E
##	16326	16328	16331	16334	16336	16338	16341	16343	16344	16345	16352	16353
##	E	E	E	E	E	E	E	E	E	E	E	E
##	16354	16365	16367	16372	16375	16378	16380	16382	16385	16386	16389	16391
##	E	E	E	E	E	E	E	E	E	E	E	E
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##	E	E	E	E	E	E	E	E	E	E	E	E
##	16431	16434	16437	16452	16454	16470	16471	16472	16482	16483	16495	16504
##	E	E	E	E	E	E	E	E	E	E	E	E
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##	E	E	E	E	E	E	E	E	E	E	E	E
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##	E	E	E	E	E	E	E	E	E	E	E	E
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##	E	E	E	E	E	E	E	E	E	E	E	E
##	16673	16676	16680	16682	16684	16687	16690	16692	16693	16699	16702	16710
##	E	E	E	E	E	E	E	E	E	E	E	E
##	16726	16729	16733	16735	16739	16741	16745	16748	16749	16754	16757	16759
##	E	E	E	E	E	E	E	E	E	E	E	E
##	16763	16770	16773	16776	16777	16778	16781	16784	16787	16794	16803	16808
##	E	E	E	E	E	E	E	E	E	E	E	E
##	16809	16820	16825	16827	16831	16832	16837	16843	16845	16851	16864	16877
##	E	E	E	E	E	E	E	E	E	E	E	E
##	16878	16879	16880	16882	16887	16891	16892	16897	16898	16899	16900	16902
##	E	E	E	E	E	E	E	E	E	E	E	E
##	16903	16913	16920	16926	16929	16930	16938	16940	16945	16948	16953	16954
##	E	E	E	E	E	E	E	E	E	E	E	E
##	16962	16970	16981	16983	16994	17002	17003	17005	17006	17024	17025	17026
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17029	17030	17036	17038	17039	17041	17044	17050	17068	17078	17081	17088
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17090	17092	17095	17096	17098	17101	17102	17104	17109	17110	17117	17118
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17121	17124	17136	17141	17145	17146	17147	17151	17160	17163	17169	17175
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17176	17178	17180	17191	17195	17201	17208	17211	1721			

##	17433	17435	17437	17438	17439	17448	17452	17460	17462	17463	17468	17474
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17479	17481	17486	17495	17502	17505	17506	17507	17516	17522	17523	17525
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17531	17532	17534	17536	17543	17544	17549	17551	17552	17554	17556	17558
##	E	E	E	E	E	E	E	E	E	E	E	E
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##	E	E	E	E	E	E	E	E	E	E	E	E
##	17605	17606	17607	17610	17614	17615	17618	17620	17621	17627	17628	17629
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17633	17638	17640	17652	17670	17681	17682	17683	17694	17699	17704	17706
##	E	E	E	E	E	E	E	E	E	E	E	E
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##	E	E	E	E	E	E	E	E	E	E	E	E
##	17750	17760	17763	17767	17771	17772	17780	17782	17788	17794	17803	17810
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17812	17815	17816	17822	17835	17836	17843	17844	17846	17847	17848	17861
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17862	17864	17873	17878	17893	17898	17901	17905	17906	17908	17912	17916
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17917	17918	17919	17921	17924	17926	17939	17940	17947	17950	17953	17954
##	E	E	E	E	E	E	E	E	E	E	E	E
##	17955	17956	17968	17978	17984	17991	17992	17994	17999	18004	18005	18007
##	E	E	E	E	E	E	E	E	E	E	E	E
##	18010	18019	18021	18022	18024	18029	18035	18036	18039	18040	18041	18045
##	E	E	E	E	E	E	E	E	E	E	E	E
##	18065	18066	18069	18071	18074	18075	18076	18078	18081	18083	18089	18095
##	E	E	E	E	E	E	E	E	E	E	E	E
##	18096	18099	18101	18107	18108	18125	18131	18136	18139	18142	18147	18148
##	E	E	E	E	E	E	E	E	E	E	E	E
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##	E	E	E	E	E	E	E	E	E	E	E	E
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##	E	E	E	E	E	E	E	E	E	E	E	E
##	18270	18273	18274	18275	18278	18280	18281	18283	18286	18288	18291	18304
##	E	E	E	E	E	E	E	E	E	E	E	E
##	18309	18310	18313	18338	18339	18345	18351	18355	18357	18358	18364	18365
##	E	E	E	E	E	E	E	E	E	E	E	E
##	18374	18379	18387	18389	18390	18396	18402	18409	1841			

```

## 18600 18604 18607 18612 18616 18618 18627 18629 18636 18637 18639 18642
##      E      E      E      E      E      E      E      E      E      E      E      E
## 18646 18660 18661 18668 18674 18675 18676 18680 18683 18692 18694 18699
##      E      E      E      E      E      E      E      E      E      E      E      E
## 18704 18708 18709 18710 18716 18719 18720 18724 18725 18729 18733 18739
##      E      E      E      E      E      E      E      E      E      E      E      E
## 18741 18755 18756 18759 18760 18766 18768 18770 18775 18776 18778 18783
##      E      E      E      E      E      E      E      E      E      E      E      E
## 18794 18801 18803 18806 18807 18810 18813 18823 18826 18828 18831 18835
##      E      E      E      E      E      E      E      E      E      E      E      E
## 18839 18859 18867 18872 18878 18880 18884 18889 18891 18892 18893 18896
##      E      E      E      E      E      E      E      E      E      E      E      E
## 18902 18903 18907 18909 18911 18915 18921 18930 18935 18940 18942 18947
##      E      E      E      E      E      E      E      E      E      E      E      E
## 18948 18949 18950 18956 18959 18968 18969 18970 18973 18976 18979 18980
##      E      E      E      E      E      E      E      E      E      E      E      E
## 18987 18989 18999 19017 19027 19029 19035 19045 19048 19050 19053 19054
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19060 19063 19066 19071 19081 19087 19091 19094 19098 19099 19106 19110
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19111 19114 19118 19119 19120 19122 19123 19124 19129 19132 19134 19136
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19145 19146 19149 19156 19157 19160 19165 19166 19168 19171 19179 19187
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19189 19190 19192 19194 19195 19201 19205 19208 19209 19212 19214 19217
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19219 19221 19227 19228 19231 19242 19245 19258 19261 19262 19264 19267
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19277 19282 19284 19298 19302 19307 19319 19326 19328 19337 19341 19347
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19350 19358 19363 19366 19370 19376 19379 19383 19385 19389 19390 19397
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19404 19417 19421 19426 19430 19431 19433 19434 19436 19444 19450 19452
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19455 19458 19459 19460 19461 19462 19465 19469 19470 19471 19483 19487
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19495 19496 19503 19510 19513 19514 19518 19526 19535 19539 19541 19543
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19550 19552 19556 19558 19559 19561 19574 19580 19583 19588 19590 19591
##      E      E      E      E      E      E      E      E      E      E      E      E
## 19595 19596 19597 19599 19607 19610 19615 19617
##      E      E      E      E      E      E      E      E
## Levels: A B C D E

```

```

pml_write_files = function(x){
  n = length(x)
  for(i in 1:20){
    filename = paste0("problem_id_",i,".txt")
    write.table(x[i],file=filename,quote=FALSE,row.names=FALSE,col.names=FALSE)
  }
}

```

```
}  
}  
  
pml_write_files(finalpredict)
```