Homework 3

PSTAT 131/231

Contents

Classification

For this assignment, we will be working with part of a Kaggle data set that was the subject of a machine learning competition and is often used for practicing ML models. The goal is classification; specifically, to predict which passengers would survive the Titanic shipwreck.
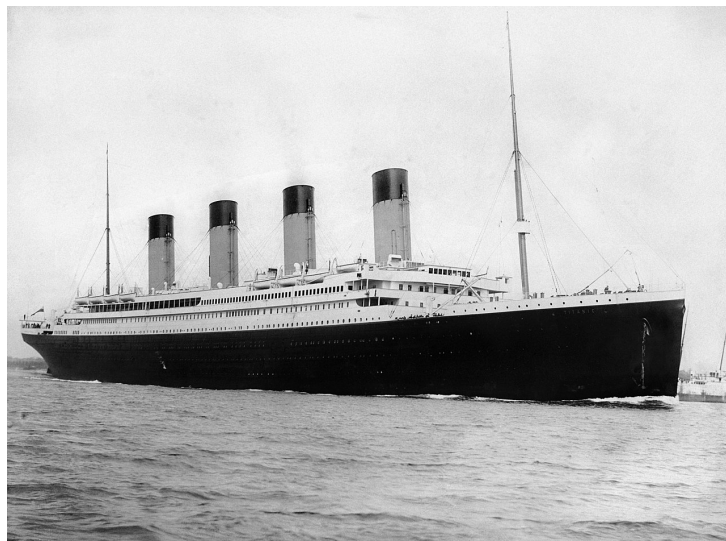

Figure 1: Fig. 1: RMS Titanic departing Southampton on April 10, 1912.

Load the data from `data/titanic.csv` into *R* and familiarize yourself with the variables it contains using the codebook (`data/titanic_codebook.txt`).

Notice that `survived` and `pclass` should be changed to factors. When changing `survived` to a factor, you may want to reorder the factor so that *"Yes"* is the first level.

Make sure you load the `tidyverse` and `tidymodels`!

Remember that you'll need to set a seed at the beginning of the document to reproduce your results.

```
titanic <- read.csv(file = "~/Downloads/homework-3/data/titanic.csv")
head(titanic)
```

```
##   passenger_id survived pclass
## 1            1       No      3
## 2            2      Yes      1
## 3            3      Yes      3
## 4            4      Yes      1
## 5            5       No      3
## 6            6       No      3
##                                                       name    sex age sib_sp parch
## 1                              Braund, Mr. Owen Harris    male  22      1     0
## 2 Cumings, Mrs. John Bradley (Florence Briggs Thayer) female  38      1     0
## 3                               Heikkinen, Miss. Laina female  26      0     0
## 4         Futrelle, Mrs. Jacques Heath (Lily May Peel) female  35      1     0
## 5                             Allen, Mr. William Henry   male  35      0     0
## 6                                     Moran, Mr. James   male  NA      0     0
##              ticket    fare cabin embarked
## 1         A/5 21171  7.2500  <NA>        S
## 2          PC 17599 71.2833   C85        C
## 3 STON/O2. 3101282  7.9250  <NA>        S
## 4            113803 53.1000  C123        S
## 5            373450  8.0500  <NA>        S
## 6            330877  8.4583  <NA>        Q
```

Question 1

Split the data, stratifying on the outcome variable, `survived`. You should choose the proportions to split the data into. Verify that the training and testing data sets have the appropriate number of observations. Take a look at the training data and note any potential issues, such as missing data.

Why is it a good idea to use stratified sampling for this data?

1. For our training and testing data sets, we have missing data for 'age,' 'cabin,' and 'embarked.' The potential issues could be reduced statistical power, the cause of bias in the estimation of parameters, and reduced representativeness of the samples.

It is a good idea to use stratified sampling for this data because our sample can be divided into mutually exclusive and exhaustive subgroups that can have different mean values for the variable. Since our data satisfies this requirement, it is a good idea to use stratified sampling for this data.

```
titanic_split <- initial_split(titanic, prop = 0.70,
                               strata = survived)
titanic_train <- training(titanic_split)
titanic_test <- testing(titanic_split)
titanic_train
```

```
##     passenger_id survived pclass
## 6              6       No      3
## 7              7       No      1
## 8              8       No      3
## 13            13       No      3
## 14            14       No      3
## 15            15       No      3
## 17            17       No      3
## 19            19       No      3
```

```
## 21          21       No     2
## 28          28       No     1
## 31          31       No     1
## 34          34       No     2
## 35          35       No     1
## 36          36       No     1
## 38          38       No     3
## 39          39       No     3
## 42          42       No     2
## 43          43       No     3
## 47          47       No     3
## 58          58       No     3
## 60          60       No     3
## 61          61       No     3
## 63          63       No     1
## 64          64       No     3
## 71          71       No     2
## 72          72       No     3
## 81          81       No     3
## 84          84       No     1
## 87          87       No     3
## 88          88       No     3
## 90          90       No     3
## 92          92       No     3
## 94          94       No     3
## 95          95       No     3
## 96          96       No     3
## 101         101      No     3
## 102         102      No     3
## 104         104      No     3
## 109         109      No     3
## 111         111      No     1
## 112         112      No     3
## 114         114      No     3
## 115         115      No     3
## 116         116      No     3
## 117         117      No     3
## 118         118      No     2
## 119         119      No     1
## 120         120      No     3
## 123         123      No     2
## 125         125      No     1
## 127         127      No     3
## 130         130      No     3
## 131         131      No     3
## 132         132      No     3
## 133         133      No     3
## 135         135      No     2
## 136         136      No     2
## 138         138      No     1
## 139         139      No     3
## 140         140      No     1
## 141         141      No     3
## 144         144      No     3
```

```
## 146          146          No          2
## 148          148          No          3
## 149          149          No          2
## 151          151          No          2
## 153          153          No          3
## 154          154          No          3
## 156          156          No          1
## 158          158          No          3
## 160          160          No          3
## 164          164          No          3
## 165          165          No          3
## 169          169          No          1
## 170          170          No          3
## 171          171          No          1
## 172          172          No          3
## 174          174          No          3
## 175          175          No          1
## 181          181          No          3
## 182          182          No          2
## 186          186          No          1
## 189          189          No          3
## 190          190          No          3
## 192          192          No          2
## 198          198          No          3
## 200          200          No          2
## 201          201          No          3
## 202          202          No          3
## 203          203          No          3
## 206          206          No          3
## 207          207          No          3
## 211          211          No          3
## 213          213          No          3
## 215          215          No          3
## 222          222          No          2
## 223          223          No          3
## 224          224          No          3
## 226          226          No          3
## 228          228          No          3
## 230          230          No          3
## 233          233          No          2
## 235          235          No          2
## 239          239          No          2
## 240          240          No          2
## 241          241          No          3
## 245          245          No          3
## 246          246          No          1
## 247          247          No          3
## 250          250          No          2
## 251          251          No          3
## 252          252          No          3
## 254          254          No          3
## 261          261          No          3
## 264          264          No          1
## 265          265          No          3
```

```
## 267          267          No          3
## 274          274          No          1
## 277          277          No          3
## 278          278          No          2
## 279          279          No          3
## 281          281          No          3
## 282          282          No          3
## 283          283          No          3
## 285          285          No          1
## 293          293          No          2
## 294          294          No          3
## 295          295          No          3
## 305          305          No          3
## 313          313          No          2
## 314          314          No          3
## 321          321          No          3
## 322          322          No          3
## 325          325          No          3
## 327          327          No          3
## 332          332          No          1
## 333          333          No          1
## 334          334          No          3
## 343          343          No          2
## 344          344          No          2
## 353          353          No          3
## 354          354          No          3
## 358          358          No          2
## 361          361          No          3
## 362          362          No          2
## 363          363          No          3
## 364          364          No          3
## 366          366          No          3
## 373          373          No          3
## 374          374          No          1
## 375          375          No          3
## 378          378          No          1
## 379          379          No          3
## 380          380          No          3
## 387          387          No          3
## 389          389          No          3
## 393          393          No          3
## 396          396          No          3
## 397          397          No          3
## 398          398          No          2
## 399          399          No          2
## 402          402          No          3
## 403          403          No          3
## 404          404          No          3
## 405          405          No          3
## 407          407          No          3
## 409          409          No          3
## 410          410          No          3
## 411          411          No          3
## 414          414          No          2
```

```
## 416           416          No        3
## 419           419          No        2
## 420           420          No        3
## 421           421          No        3
## 422           422          No        3
## 423           423          No        3
## 424           424          No        3
## 426           426          No        3
## 429           429          No        3
## 434           434          No        3
## 435           435          No        1
## 437           437          No        3
## 440           440          No        2
## 443           443          No        3
## 451           451          No        2
## 452           452          No        3
## 453           453          No        1
## 455           455          No        3
## 457           457          No        1
## 460           460          No        3
## 462           462          No        3
## 463           463          No        1
## 464           464          No        2
## 466           466          No        3
## 468           468          No        1
## 469           469          No        3
## 471           471          No        3
## 472           472          No        3
## 475           475          No        3
## 476           476          No        1
## 478           478          No        3
## 479           479          No        3
## 481           481          No        3
## 482           482          No        2
## 483           483          No        3
## 486           486          No        3
## 488           488          No        1
## 493           493          No        1
## 494           494          No        1
## 495           495          No        3
## 496           496          No        3
## 499           499          No        1
## 500           500          No        3
## 501           501          No        3
## 502           502          No        3
## 503           503          No        3
## 504           504          No        3
## 512           512          No        3
## 515           515          No        3
## 516           516          No        1
## 518           518          No        3
## 522           522          No        3
## 523           523          No        3
## 525           525          No        3
```

```
## 528          528          No          1
## 530          530          No          2
## 532          532          No          3
## 542          542          No          3
## 545          545          No          1
## 549          549          No          3
## 553          553          No          3
## 556          556          No          1
## 558          558          No          1
## 561          561          No          3
## 562          562          No          3
## 563          563          No          2
## 564          564          No          3
## 566          566          No          3
## 567          567          No          3
## 568          568          No          3
## 569          569          No          3
## 575          575          No          3
## 576          576          No          3
## 583          583          No          2
## 584          584          No          1
## 585          585          No          3
## 587          587          No          2
## 590          590          No          3
## 593          593          No          3
## 594          594          No          3
## 595          595          No          2
## 596          596          No          3
## 598          598          No          3
## 599          599          No          3
## 602          602          No          3
## 603          603          No          1
## 604          604          No          3
## 606          606          No          3
## 607          607          No          3
## 617          617          No          3
## 618          618          No          3
## 621          621          No          3
## 624          624          No          3
## 625          625          No          3
## 626          626          No          1
## 627          627          No          2
## 629          629          No          3
## 630          630          No          3
## 637          637          No          3
## 638          638          No          2
## 639          639          No          3
## 640          640          No          3
## 641          641          No          3
## 643          643          No          3
## 647          647          No          3
## 649          649          No          3
## 653          653          No          3
## 656          656          No          2
```

```
## 657            657       No        3
## 659            659       No        2
## 662            662       No        3
## 664            664       No        3
## 667            667       No        2
## 668            668       No        3
## 669            669       No        3
## 672            672       No        1
## 675            675       No        2
## 677            677       No        3
## 679            679       No        3
## 681            681       No        3
## 683            683       No        3
## 684            684       No        3
## 687            687       No        3
## 689            689       No        3
## 694            694       No        3
## 695            695       No        1
## 696            696       No        2
## 697            697       No        3
## 699            699       No        1
## 700            700       No        3
## 705            705       No        3
## 712            712       No        1
## 714            714       No        3
## 715            715       No        2
## 716            716       No        3
## 719            719       No        3
## 723            723       No        2
## 726            726       No        3
## 729            729       No        2
## 730            730       No        3
## 732            732       No        3
## 733            733       No        2
## 734            734       No        2
## 735            735       No        2
## 736            736       No        3
## 737            737       No        3
## 740            740       No        3
## 742            742       No        1
## 744            744       No        3
## 746            746       No        1
## 747            747       No        3
## 749            749       No        1
## 750            750       No        3
## 754            754       No        3
## 757            757       No        3
## 758            758       No        2
## 759            759       No        3
## 761            761       No        3
## 762            762       No        3
## 767            767       No        1
## 770            770       No        3
## 773            773       No        2
```

```
## 774          774        No      3
## 776          776        No      3
## 779          779        No      3
## 783          783        No      1
## 784          784        No      3
## 791          791        No      3
## 792          792        No      2
## 793          793        No      3
## 795          795        No      3
## 796          796        No      2
## 799          799        No      3
## 800          800        No      3
## 806          806        No      3
## 807          807        No      1
## 809          809        No      2
## 811          811        No      3
## 812          812        No      3
## 813          813        No      2
## 814          814        No      3
## 817          817        No      3
## 818          818        No      2
## 819          819        No      3
## 827          827        No      3
## 833          833        No      3
## 834          834        No      3
## 835          835        No      3
## 837          837        No      3
## 841          841        No      3
## 842          842        No      2
## 844          844        No      3
## 845          845        No      3
## 846          846        No      3
## 849          849        No      2
## 852          852        No      3
## 853          853        No      3
## 855          855        No      2
## 862          862        No      2
## 865          865        No      2
## 868          868        No      1
## 869          869        No      3
## 871          871        No      3
## 873          873        No      1
## 874          874        No      3
## 878          878        No      3
## 879          879        No      3
## 882          882        No      3
## 883          883        No      3
## 885          885        No      3
## 886          886        No      3
## 887          887        No      2
## 889          889        No      3
## 891          891        No      3
## 2              2        Yes      1
## 3              3        Yes      3
```

```
## 4          4      Yes    1
## 9          9      Yes    3
## 11        11      Yes    3
## 16        16      Yes    2
## 24        24      Yes    1
## 26        26      Yes    3
## 29        29      Yes    3
## 32        32      Yes    1
## 33        33      Yes    3
## 37        37      Yes    3
## 40        40      Yes    3
## 44        44      Yes    2
## 45        45      Yes    3
## 48        48      Yes    3
## 53        53      Yes    1
## 59        59      Yes    2
## 62        62      Yes    1
## 66        66      Yes    3
## 69        69      Yes    3
## 75        75      Yes    3
## 79        79      Yes    2
## 82        82      Yes    3
## 85        85      Yes    2
## 86        86      Yes    3
## 99        99      Yes    2
## 108      108      Yes    3
## 110      110      Yes    3
## 124      124      Yes    2
## 126      126      Yes    3
## 128      128      Yes    3
## 129      129      Yes    3
## 137      137      Yes    1
## 142      142      Yes    3
## 143      143      Yes    3
## 147      147      Yes    3
## 157      157      Yes    3
## 162      162      Yes    2
## 167      167      Yes    1
## 173      173      Yes    3
## 184      184      Yes    2
## 185      185      Yes    3
## 191      191      Yes    2
## 194      194      Yes    2
## 195      195      Yes    1
## 196      196      Yes    1
## 205      205      Yes    3
## 208      208      Yes    3
## 209      209      Yes    3
## 210      210      Yes    1
## 212      212      Yes    2
## 216      216      Yes    1
## 217      217      Yes    3
## 219      219      Yes    1
## 221      221      Yes    3
```

```
## 225          225          Yes          1
## 238          238          Yes          2
## 242          242          Yes          3
## 248          248          Yes          2
## 256          256          Yes          3
## 258          258          Yes          1
## 260          260          Yes          2
## 262          262          Yes          3
## 268          268          Yes          3
## 273          273          Yes          2
## 276          276          Yes          1
## 280          280          Yes          3
## 290          290          Yes          3
## 291          291          Yes          1
## 299          299          Yes          1
## 300          300          Yes          1
## 302          302          Yes          3
## 304          304          Yes          2
## 306          306          Yes          1
## 307          307          Yes          1
## 308          308          Yes          1
## 310          310          Yes          1
## 311          311          Yes          1
## 317          317          Yes          2
## 319          319          Yes          1
## 320          320          Yes          1
## 324          324          Yes          2
## 326          326          Yes          1
## 328          328          Yes          2
## 329          329          Yes          3
## 335          335          Yes          1
## 338          338          Yes          1
## 341          341          Yes          2
## 342          342          Yes          1
## 347          347          Yes          2
## 348          348          Yes          3
## 357          357          Yes          1
## 359          359          Yes          3
## 360          360          Yes          3
## 367          367          Yes          1
## 368          368          Yes          3
## 371          371          Yes          1
## 376          376          Yes          1
## 377          377          Yes          3
## 382          382          Yes          3
## 388          388          Yes          2
## 391          391          Yes          1
## 392          392          Yes          3
## 394          394          Yes          1
## 395          395          Yes          3
## 400          400          Yes          2
## 401          401          Yes          3
## 408          408          Yes          2
## 413          413          Yes          1
```

```
## 417      417      Yes      2
## 418      418      Yes      2
## 427      427      Yes      2
## 431      431      Yes      1
## 432      432      Yes      3
## 433      433      Yes      2
## 436      436      Yes      1
## 438      438      Yes      2
## 441      441      Yes      2
## 444      444      Yes      2
## 445      445      Yes      3
## 447      447      Yes      2
## 448      448      Yes      1
## 449      449      Yes      3
## 450      450      Yes      1
## 456      456      Yes      3
## 458      458      Yes      1
## 459      459      Yes      2
## 470      470      Yes      3
## 473      473      Yes      2
## 474      474      Yes      2
## 484      484      Yes      3
## 490      490      Yes      3
## 497      497      Yes      1
## 505      505      Yes      1
## 507      507      Yes      2
## 510      510      Yes      3
## 511      511      Yes      3
## 513      513      Yes      1
## 517      517      Yes      2
## 521      521      Yes      1
## 524      524      Yes      1
## 527      527      Yes      2
## 534      534      Yes      3
## 536      536      Yes      2
## 538      538      Yes      1
## 540      540      Yes      1
## 544      544      Yes      2
## 547      547      Yes      2
## 550      550      Yes      2
## 551      551      Yes      1
## 554      554      Yes      3
## 555      555      Yes      3
## 557      557      Yes      1
## 559      559      Yes      1
## 560      560      Yes      3
## 570      570      Yes      3
## 571      571      Yes      2
## 572      572      Yes      1
## 574      574      Yes      3
## 577      577      Yes      2
## 580      580      Yes      3
## 581      581      Yes      2
## 582      582      Yes      1
```

```
## 586          586          Yes          1
## 588          588          Yes          1
## 592          592          Yes          1
## 597          597          Yes          2
## 600          600          Yes          1
## 601          601          Yes          2
## 608          608          Yes          1
## 609          609          Yes          2
## 610          610          Yes          1
## 613          613          Yes          3
## 616          616          Yes          2
## 619          619          Yes          2
## 623          623          Yes          3
## 628          628          Yes          1
## 631          631          Yes          1
## 636          636          Yes          2
## 642          642          Yes          1
## 645          645          Yes          3
## 646          646          Yes          1
## 648          648          Yes          1
## 650          650          Yes          3
## 654          654          Yes          3
## 661          661          Yes          1
## 665          665          Yes          3
## 674          674          Yes          2
## 678          678          Yes          3
## 680          680          Yes          1
## 682          682          Yes          1
## 690          690          Yes          1
## 692          692          Yes          3
## 693          693          Yes          3
## 711          711          Yes          1
## 717          717          Yes          1
## 721          721          Yes          2
## 725          725          Yes          1
## 727          727          Yes          2
## 728          728          Yes          3
## 731          731          Yes          1
## 738          738          Yes          1
## 741          741          Yes          1
## 743          743          Yes          1
## 745          745          Yes          3
## 748          748          Yes          2
## 752          752          Yes          3
## 760          760          Yes          1
## 763          763          Yes          3
## 778          778          Yes          3
## 780          780          Yes          1
## 781          781          Yes          3
## 787          787          Yes          3
## 802          802          Yes          2
## 803          803          Yes          1
## 804          804          Yes          3
## 805          805          Yes          3
```

```
## 810          810          Yes          1
## 821          821          Yes          1
## 822          822          Yes          3
## 824          824          Yes          3
## 828          828          Yes          2
## 829          829          Yes          3
## 830          830          Yes          1
## 832          832          Yes          2
## 836          836          Yes          1
## 839          839          Yes          3
## 843          843          Yes          1
## 850          850          Yes          1
## 857          857          Yes          1
## 858          858          Yes          1
## 859          859          Yes          3
## 863          863          Yes          1
## 872          872          Yes          1
## 875          875          Yes          2
## 880          880          Yes          1
## 888          888          Yes          1
## 890          890          Yes          1
##                                                                        name
## 6                                                          Moran, Mr. James
## 7                                                     McCarthy, Mr. Timothy J
## 8                                                 Palsson, Master. Gosta Leonard
## 13                                             Saundercock, Mr. William Henry
## 14                                               Andersson, Mr. Anders Johan
## 15                                       Vestrom, Miss. Hulda Amanda Adolfina
## 17                                                       Rice, Master. Eugene
## 19                      Vander Planke, Mrs. Julius (Emelia Maria Vandemoortele)
## 21                                                      Fynney, Mr. Joseph J
## 28                                              Fortune, Mr. Charles Alexander
## 31                                                    Uruchurtu, Don. Manuel E
## 34                                                      Wheadon, Mr. Edward H
## 35                                                     Meyer, Mr. Edgar Joseph
## 36                                                Holverson, Mr. Alexander Oskar
## 38                                                   Cann, Mr. Ernest Charles
## 39                                             Vander Planke, Miss. Augusta Maria
## 42              Turpin, Mrs. William John Robert (Dorothy Ann Wonnacott)
## 43                                                       Kraeff, Mr. Theodor
## 47                                                         Lennon, Mr. Denis
## 58                                                       Novel, Mr. Mansouer
## 60                                             Goodwin, Master. William Frederick
## 61                                                    Sirayanian, Mr. Orsen
## 63                                                 Harris, Mr. Henry Birkhardt
## 64                                                       Skoog, Master. Harald
## 71                                                  Jenkin, Mr. Stephen Curnow
## 72                                                   Goodwin, Miss. Lillian Amy
## 81                                                       Waelens, Mr. Achille
## 84                                                    Carrau, Mr. Francisco M
## 87                                                       Ford, Mr. William Neal
## 88                                                 Slocovski, Mr. Selman Francis
## 90                                                       Celotti, Mr. Francesco
## 92                                                  Andreasson, Mr. Paul Edvin
```

```
## 94                            Dean, Mr. Bertram Frank
## 95                                 Coxon, Mr. Daniel
## 96                         Shorney, Mr. Charles Joseph
## 101                            Petranec, Miss. Matilda
## 102                      Petroff, Mr. Pastcho ("Pentcho")
## 104                         Johansson, Mr. Gustaf Joel
## 109                                  Rekic, Mr. Tido
## 111                      Porter, Mr. Walter Chamberlain
## 112                              Zabour, Miss. Hileni
## 114                            Jussila, Miss. Katriina
## 115                             Attalah, Miss. Malake
## 116                             Pekoniemi, Mr. Edvard
## 117                              Connors, Mr. Patrick
## 118                       Turpin, Mr. William John Robert
## 119                           Baxter, Mr. Quigg Edmond
## 120                     Andersson, Miss. Ellis Anna Maria
## 123                             Nasser, Mr. Nicholas
## 125                         White, Mr. Percival Wayland
## 127                              McMahon, Mr. Martin
## 130                               Ekstrom, Mr. Johan
## 131                             Drazenoic, Mr. Jozef
## 132                     Coelho, Mr. Domingos Fernandeo
## 133            Robins, Mrs. Alexander A (Grace Charity Laury)
## 135                     Sobey, Mr. Samuel James Hayden
## 136                               Richard, Mr. Emile
## 138                         Futrelle, Mr. Jacques Heath
## 139                              Osen, Mr. Olaf Elon
## 140                               Giglio, Mr. Victor
## 141                        Boulos, Mrs. Joseph (Sultana)
## 144                              Burke, Mr. Jeremiah
## 146                         Nicholls, Mr. Joseph Charles
## 148                       Ford, Miss. Robina Maggie "Ruby"
## 149                  Navratil, Mr. Michel ("Louis M Hoffman")
## 151                          Bateman, Rev. Robert James
## 153                                 Meo, Mr. Alfonzo
## 154                       van Billiard, Mr. Austin Blyler
## 156                         Williams, Mr. Charles Duane
## 158                                 Corn, Mr. Harry
## 160                         Sage, Master. Thomas Henry
## 164                                 Calic, Mr. Jovo
## 165                        Panula, Master. Eino Viljami
## 169                              Baumann, Mr. John D
## 170                                  Ling, Mr. Lee
## 171                          Van der hoef, Mr. Wyckoff
## 172                              Rice, Master. Arthur
## 174                          Sivola, Mr. Antti Wilhelm
## 175                            Smith, Mr. James Clinch
## 181                        Sage, Miss. Constance Gladys
## 182                                Pernot, Mr. Rene
## 186                            Rood, Mr. Hugh Roscoe
## 189                                 Bourke, Mr. John
## 190                              Turcin, Mr. Stjepan
## 192                            Carbines, Mr. William
## 198                     Olsen, Mr. Karl Siegwart Andreas
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## 200                      Yrois, Miss. Henriette ("Mrs Harbeck")
## 201                          Vande Walle, Mr. Nestor Cyriel
## 202                                    Sage, Mr. Frederick
## 203                             Johanson, Mr. Jakob Alfred
## 206                              Strom, Miss. Telma Matilda
## 207                             Backstrom, Mr. Karl Alfred
## 211                                        Ali, Mr. Ahmed
## 213                                 Perkin, Mr. John Henry
## 215                                  Kiernan, Mr. Philip
## 222                                 Bracken, Mr. James H
## 223                               Green, Mr. George Henry
## 224                                   Nenkoff, Mr. Christo
## 226                          Berglund, Mr. Karl Ivar Sven
## 228                          Lovell, Mr. John Hall ("Henry")
## 230                                Lefebre, Miss. Mathilde
## 233                              Sjostedt, Mr. Ernst Adolf
## 235                      Leyson, Mr. Robert William Norman
## 239                       Pengelly, Mr. Frederick William
## 240                               Hunt, Mr. George Henry
## 241                                 Zabour, Miss. Thamine
## 245                                 Attalah, Mr. Sleiman
## 246                           Minahan, Dr. William Edward
## 247                 Lindahl, Miss. Agda Thorilda Viktoria
## 250                        Carter, Rev. Ernest Courtenay
## 251                               Reed, Mr. James George
## 252                Strom, Mrs. Wilhelm (Elna Matilda Persson)
## 254                            Lobb, Mr. William Arthur
## 261                                  Smith, Mr. Thomas
## 264                               Harrison, Mr. William
## 265                                  Henry, Miss. Delia
## 267                             Panula, Mr. Ernesti Arvid
## 274                               Natsch, Mr. Charles H
## 277                       Lindblom, Miss. Augusta Charlotta
## 278                           Parkes, Mr. Francis "Frank"
## 279                                   Rice, Master. Eric
## 281                                    Duane, Mr. Frank
## 282               Olsson, Mr. Nils Johan Goransson
## 283                            de Pelsmaeker, Mr. Alfons
## 285                          Smith, Mr. Richard William
## 293                            Levy, Mr. Rene Jacques
## 294                                 Haas, Miss. Aloisia
## 295                                    Mineff, Mr. Ivan
## 305                     Williams, Mr. Howard Hugh "Harry"
## 313                    Lahtinen, Mrs. William (Anna Sylfven)
## 314                            Hendekovic, Mr. Ignjac
## 321                                  Dennis, Mr. Samuel
## 322                                    Danoff, Mr. Yoto
## 325                           Sage, Mr. George John Jr
## 327                           Nysveen, Mr. Johan Hansen
## 332                                 Partner, Mr. Austen
## 333                          Graham, Mr. George Edward
## 334                       Vander Planke, Mr. Leo Edmondus
## 343                          Collander, Mr. Erik Gustaf
## 344                 Sedgwick, Mr. Charles Frederick Waddington
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## 353                                       Elias, Mr. Tannous
## 354                                Arnold-Franchi, Mr. Josef
## 358                               Funk, Miss. Annie Clemmer
## 361                                     Skoog, Mr. Wilhelm
## 362                                 del Carlo, Mr. Sebastiano
## 363                            Barbara, Mrs. (Catherine David)
## 364                                         Asim, Mr. Adola
## 366                             Adahl, Mr. Mauritz Nils Martin
## 373                              Beavan, Mr. William Thomas
## 374                                    Ringhini, Mr. Sante
## 375                               Palsson, Miss. Stina Viola
## 378                                 Widener, Mr. Harry Elkins
## 379                                     Betros, Mr. Tannous
## 380                              Gustafsson, Mr. Karl Gideon
## 387                           Goodwin, Master. Sidney Leonard
## 389                                    Sadlier, Mr. Matthew
## 393                             Gustafsson, Mr. Johan Birger
## 396                                  Johansson, Mr. Erik
## 397                                   Olsson, Miss. Elina
## 398                                 McKane, Mr. Peter David
## 399                                     Pain, Dr. Alfred
## 402                                      Adams, Mr. John
## 403                                Jussila, Miss. Mari Aina
## 404                            Hakkarainen, Mr. Pekka Pietari
## 405                               Oreskovic, Miss. Marija
## 407                           Widegren, Mr. Carl/Charles Peter
## 409                           Birkeland, Mr. Hans Martin Monsen
## 410                                    Lefebre, Miss. Ida
## 411                                     Sdycoff, Mr. Todor
## 414                              Cunningham, Mr. Alfred Fleming
## 416                       Meek, Mrs. Thomas (Annie Louise Rowley)
## 419                              Matthews, Mr. William John
## 420                                Van Impe, Miss. Catharina
## 421                                 Gheorgheff, Mr. Stanio
## 422                                   Charters, Mr. David
## 423                                   Zimmerman, Mr. Leo
## 424       Danbom, Mrs. Ernst Gilbert (Anna Sigrid Maria Brogren)
## 426                                 Wiseman, Mr. Phillippe
## 429                                      Flynn, Mr. James
## 434                              Kallio, Mr. Nikolai Erland
## 435                                Silvey, Mr. William Baird
## 437                           Ford, Miss. Doolina Margaret "Daisy"
## 440                          Kvillner, Mr. Johan Henrik Johannesson
## 443                               Petterson, Mr. Johan Emil
## 451                                   West, Mr. Edwy Arthur
## 452                              Hagland, Mr. Ingvald Olai Olsen
## 453                             Foreman, Mr. Benjamin Laventall
## 455                                    Peduzzi, Mr. Joseph
## 457                                 Millet, Mr. Francis Davis
## 460                                 O'Connor, Mr. Maurice
## 462                                    Morley, Mr. William
## 463                                     Gee, Mr. Arthur H
## 464                               Milling, Mr. Jacob Christian
## 466                            Goncalves, Mr. Manuel Estanslas
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## 468                            Smart, Mr. John Montgomery
## 469                                  Scanlan, Mr. James
## 471                                   Keefe, Mr. Arthur
## 472                                    Cacic, Mr. Luka
## 475                         Strandberg, Miss. Ida Sofia
## 476                          Clifford, Mr. George Quincy
## 478                           Braund, Mr. Lewis Richard
## 479                            Karlsson, Mr. Nils August
## 481                        Goodwin, Master. Harold Victor
## 482                        Frost, Mr. Anthony Wood "Archie"
## 483                           Rouse, Mr. Richard Henry
## 486                            Lefebre, Miss. Jeannie
## 488                            Kent, Mr. Edward Austin
## 493                          Molson, Mr. Harry Markland
## 494                           Artagaveytia, Mr. Ramon
## 495                          Stanley, Mr. Edward Roland
## 496                             Yousseff, Mr. Gerious
## 499               Allison, Mrs. Hudson J C (Bessie Waldo Daniels)
## 500                               Svensson, Mr. Olof
## 501                                 Calic, Mr. Petar
## 502                               Canavan, Miss. Mary
## 503                        O'Sullivan, Miss. Bridget Mary
## 504                         Laitinen, Miss. Kristina Sofia
## 512                                Webber, Mr. James
## 515                                Coleff, Mr. Satio
## 516                         Walker, Mr. William Anderson
## 518                               Ryan, Mr. Patrick
## 522                                 Vovk, Mr. Janko
## 523                               Lahoud, Mr. Sarkis
## 525                                Kassem, Mr. Fared
## 528                               Farthing, Mr. John
## 530                         Hocking, Mr. Richard George
## 532                                Toufik, Mr. Nakli
## 542                        Andersson, Miss. Ingeborg Constanzia
## 545                          Douglas, Mr. Walter Donald
## 549                          Goldsmith, Mr. Frank John
## 553                              O'Brien, Mr. Timothy
## 556                              Wright, Mr. George
## 558                              Robbins, Mr. Victor
## 561                          Morrow, Mr. Thomas Rowan
## 562                                Sivic, Mr. Husein
## 563                          Norman, Mr. Robert Douglas
## 564                               Simmons, Mr. John
## 566                              Davies, Mr. Alfred J
## 567                             Stoytcheff, Mr. Ilia
## 568               Palsson, Mrs. Nils (Alma Cornelia Berglund)
## 569                              Doharr, Mr. Tannous
## 575                        Rush, Mr. Alfred George John
## 576                              Patchett, Mr. George
## 583                         Downton, Mr. William James
## 584                                Ross, Mr. John Hugo
## 585                              Paulner, Mr. Uscher
## 587                             Jarvis, Mr. John Denzil
## 590                               Murdlin, Mr. Joseph
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## 593                                 Elsbury, Mr. William James
## 594                                       Bourke, Miss. Mary
## 595                                 Chapman, Mr. John Henry
## 596                             Van Impe, Mr. Jean Baptiste
## 598                                     Johnson, Mr. Alfred
## 599                                      Boulos, Mr. Hanna
## 602                                   Slabenoff, Mr. Petco
## 603                               Harrington, Mr. Charles H
## 604                               Torber, Mr. Ernst William
## 606                             Lindell, Mr. Edvard Bengtsson
## 607                                     Karaic, Mr. Milan
## 617                               Danbom, Mr. Ernst Gilbert
## 618          Lobb, Mrs. William Arthur (Cordelia K Stanlick)
## 621                                    Yasbeck, Mr. Antoni
## 624                           Hansen, Mr. Henry Damsgaard
## 625                             Bowen, Mr. David John "Dai"
## 626                                 Sutton, Mr. Frederick
## 627                         Kirkland, Rev. Charles Leonard
## 629                             Bostandyeff, Mr. Guentcho
## 630                             O'Connell, Mr. Patrick D
## 637                           Leinonen, Mr. Antti Gustaf
## 638                                   Collyer, Mr. Harvey
## 639              Panula, Mrs. Juha (Maria Emilia Ojala)
## 640                           Thorneycroft, Mr. Percival
## 641                               Jensen, Mr. Hans Peder
## 643                         Skoog, Miss. Margit Elizabeth
## 647                                    Cor, Mr. Liudevit
## 649                                   Willey, Mr. Edward
## 653                         Kalvik, Mr. Johannes Halvorsen
## 656                             Hickman, Mr. Leonard Mark
## 657                               Radeff, Mr. Alexander
## 659                           Eitemiller, Mr. George Floyd
## 662                                  Badt, Mr. Mohamed
## 664                                    Coleff, Mr. Peju
## 667                         Butler, Mr. Reginald Fenton
## 668                         Rommetvedt, Mr. Knud Paust
## 669                                     Cook, Mr. Jacob
## 672                           Davidson, Mr. Thornton
## 675                           Watson, Mr. Ennis Hastings
## 677                         Sawyer, Mr. Frederick Charles
## 679              Goodwin, Mrs. Frederick (Augusta Tyler)
## 681                                   Peters, Miss. Katie
## 683                             Olsvigen, Mr. Thor Anderson
## 684                           Goodwin, Mr. Charles Edward
## 687                             Panula, Mr. Jaako Arnold
## 689                         Fischer, Mr. Eberhard Thelander
## 694                                     Saad, Mr. Khalil
## 695                                     Weir, Col. John
## 696                             Chapman, Mr. Charles Henry
## 697                                     Kelly, Mr. James
## 699                             Thayer, Mr. John Borland
## 700          Humblen, Mr. Adolf Mathias Nicolai Olsen
## 705                               Hansen, Mr. Henrik Juul
## 712                                   Klaber, Mr. Herman
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## 714                                       Larsson, Mr. August Viktor
## 715                                       Greenberg, Mr. Samuel
## 716              Soholt, Mr. Peter Andreas Lauritz Andersen
## 719                                       McEvoy, Mr. Michael
## 723                                 Gillespie, Mr. William Henry
## 726                                       Oreskovic, Mr. Luka
## 729                              Bryhl, Mr. Kurt Arnold Gottfrid
## 730                               Ilmakangas, Miss. Pieta Sofia
## 732                                 Hassan, Mr. Houssein G N
## 733                                     Knight, Mr. Robert J
## 734                                 Berriman, Mr. William John
## 735                             Troupiansky, Mr. Moses Aaron
## 736                                       Williams, Mr. Leslie
## 737                  Ford, Mrs. Edward (Margaret Ann Watson)
## 740                                       Nankoff, Mr. Minko
## 742                             Cavendish, Mr. Tyrell William
## 744                                       McNamee, Mr. Neal
## 746                               Crosby, Capt. Edward Gifford
## 747                               Abbott, Mr. Rossmore Edward
## 749                                 Marvin, Mr. Daniel Warner
## 750                               Connaghton, Mr. Michael
## 754                                       Jonkoff, Mr. Lalio
## 757                             Carlsson, Mr. August Sigfrid
## 758                                 Bailey, Mr. Percy Andrew
## 759                             Theobald, Mr. Thomas Leonard
## 761                                       Garfirth, Mr. John
## 762                           Nirva, Mr. Iisakki Antino Aijo
## 767                               Brewe, Dr. Arthur Jackson
## 770                         Gronnestad, Mr. Daniel Danielsen
## 773                                       Mack, Mrs. (Mary)
## 774                                       Elias, Mr. Dibo
## 776              Myhrman, Mr. Pehr Fabian Oliver Malkolm
## 779                                 Kilgannon, Mr. Thomas J
## 783                                     Long, Mr. Milton Clyde
## 784                                 Johnston, Mr. Andrew G
## 791                                 Keane, Mr. Andrew "Andy"
## 792                                       Gaskell, Mr. Alfred
## 793                                 Sage, Miss. Stella Anna
## 795                                 Dantcheff, Mr. Ristiu
## 796                                       Otter, Mr. Richard
## 799                             Ibrahim Shawah, Mr. Yousseff
## 800        Van Impe, Mrs. Jean Baptiste (Rosalie Paula Govaert)
## 806                             Johansson, Mr. Karl Johan
## 807                                 Andrews, Mr. Thomas Jr
## 809                                       Meyer, Mr. August
## 811                                 Alexander, Mr. William
## 812                                       Lester, Mr. James
## 813                               Slemen, Mr. Richard James
## 814                         Andersson, Miss. Ebba Iris Alfrida
## 817                             Heininen, Miss. Wendla Maria
## 818                                       Mallet, Mr. Albert
## 819              Holm, Mr. John Fredrik Alexander
## 827                                       Lam, Mr. Len
## 833                                       Saad, Mr. Amin
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## 834                                  Augustsson, Mr. Albert
## 835                                 Allum, Mr. Owen George
## 837                                     Pasic, Mr. Jakob
## 841                             Alhomaki, Mr. Ilmari Rudolf
## 842                                Mudd, Mr. Thomas Charles
## 844                            Lemberopolous, Mr. Peter L
## 845                                  Culumovic, Mr. Jeso
## 846                                   Abbing, Mr. Anthony
## 849                                    Harper, Rev. John
## 852                                  Svensson, Mr. Johan
## 853                                Boulos, Miss. Nourelain
## 855                    Carter, Mrs. Ernest Courtenay (Lilian Hughes)
## 862                              Giles, Mr. Frederick Edward
## 865                                Gill, Mr. John William
## 868                       Roebling, Mr. Washington Augustus II
## 869                            van Melkebeke, Mr. Philemon
## 871                                   Balkic, Mr. Cerin
## 873                               Carlsson, Mr. Frans Olof
## 874                             Vander Cruyssen, Mr. Victor
## 878                                 Petroff, Mr. Nedelio
## 879                                   Laleff, Mr. Kristo
## 882                                   Markun, Mr. Johann
## 883                             Dahlberg, Miss. Gerda Ulrika
## 885                                Sutehall, Mr. Henry Jr
## 886                         Rice, Mrs. William (Margaret Norton)
## 887                                Montvila, Rev. Juozas
## 889                        Johnston, Miss. Catherine Helen "Carrie"
## 891                                   Dooley, Mr. Patrick
## 2                       Cumings, Mrs. John Bradley (Florence Briggs Thayer)
## 3                                   Heikkinen, Miss. Laina
## 4                         Futrelle, Mrs. Jacques Heath (Lily May Peel)
## 9                       Johnson, Mrs. Oscar W (Elisabeth Vilhelmina Berg)
## 11                              Sandstrom, Miss. Marguerite Rut
## 16                               Hewlett, Mrs. (Mary D Kingcome)
## 24                               Sloper, Mr. William Thompson
## 26                    Asplund, Mrs. Carl Oscar (Selma Augusta Emilia Johansson)
## 29                                O'Dwyer, Miss. Ellen "Nellie"
## 32                       Spencer, Mrs. William Augustus (Marie Eugenie)
## 33                                 Glynn, Miss. Mary Agatha
## 37                                     Mamee, Mr. Hanna
## 40                                Nicola-Yarred, Miss. Jamila
## 44                         Laroche, Miss. Simonne Marie Anne Andree
## 45                                Devaney, Miss. Margaret Delia
## 48                                 O'Driscoll, Miss. Bridget
## 53                         Harper, Mrs. Henry Sleeper (Myna Haxtun)
## 59                               West, Miss. Constance Mirium
## 62                                    Icard, Miss. Amelie
## 66                                 Moubarek, Master. Gerios
## 69                               Andersson, Miss. Erna Alexandra
## 75                                       Bing, Mr. Lee
## 79                                Caldwell, Master. Alden Gates
## 82                                Sheerlinck, Mr. Jan Baptist
## 85                                    Ilett, Miss. Bertha
## 86                    Backstrom, Mrs. Karl Alfred (Maria Mathilda Gustafsson)
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## 99                                              Doling, Mrs. John T (Ada Julia Bone)
## 108                                                        Moss, Mr. Albert Johan
## 110                                                          Moran, Miss. Bertha
## 124                                                          Webber, Miss. Susan
## 126                                                  Nicola-Yarred, Master. Elias
## 128                                                    Madsen, Mr. Fridtjof Arne
## 129                                                            Peter, Miss. Anna
## 137                                                 Newsom, Miss. Helen Monypeny
## 142                                                    Nysten, Miss. Anna Sofia
## 143                              Hakkarainen, Mrs. Pekka Pietari (Elin Matilda Dolck)
## 147                                   Andersson, Mr. August Edvard ("Wennerstrom")
## 157                                           Gilnagh, Miss. Katherine "Katie"
## 162                            Watt, Mrs. James (Elizabeth "Bessie" Inglis Milne)
## 167                                   Chibnall, Mrs. (Edith Martha Bowerman)
## 173                                              Johnson, Miss. Eleanor Ileen
## 184                                                  Becker, Master. Richard F
## 185                                      Kink-Heilmann, Miss. Luise Gretchen
## 191                                                          Pinsky, Mrs. (Rosa)
## 194                                                  Navratil, Master. Michel M
## 195                              Brown, Mrs. James Joseph (Margaret Tobin)
## 196                                                        Lurette, Miss. Elise
## 205                                                    Cohen, Mr. Gurshon "Gus"
## 208                                              Albimona, Mr. Nassef Cassem
## 209                                                  Carr, Miss. Helen "Ellen"
## 210                                                            Blank, Mr. Henry
## 212                                                  Cameron, Miss. Clear Annie
## 216                                                    Newell, Miss. Madeleine
## 217                                                      Honkanen, Miss. Eliina
## 219                                                      Bazzani, Miss. Albina
## 221                                             Sunderland, Mr. Victor Francis
## 225                                              Hoyt, Mr. Frederick Maxfield
## 238                                           Collyer, Miss. Marjorie "Lottie"
## 242                                          Murphy, Miss. Katherine "Kate"
## 248                                        Hamalainen, Mrs. William (Anna)
## 256                                  Touma, Mrs. Darwis (Hanne Youssef Razi)
## 258                                                        Cherry, Miss. Gladys
## 260                                                  Parrish, Mrs. (Lutie Davis)
## 262                                        Asplund, Master. Edvin Rojj Felix
## 268                                                      Persson, Mr. Ernst Ulrik
## 273                                  Mellinger, Mrs. (Elizabeth Anne Maidment)
## 276                                          Andrews, Miss. Kornelia Theodosia
## 280                                              Abbott, Mrs. Stanton (Rosa Hunt)
## 290                                                          Connolly, Miss. Kate
## 291                                              Barber, Miss. Ellen "Nellie"
## 299                                                        Saalfeld, Mr. Adolphe
## 300                              Baxter, Mrs. James (Helene DeLaudeniere Chaput)
## 302                                                          McCoy, Mr. Bernard
## 304                                                          Keane, Miss. Nora A
## 306                                              Allison, Master. Hudson Trevor
## 307                                                      Fleming, Miss. Margaret
## 308 Penasco y Castellana, Mrs. Victor de Satode (Maria Josefa Perez de Soto y Vallejo)
## 310                                              Francatelli, Miss. Laura Mabel
## 311                                              Hays, Miss. Margaret Bechstein
## 317                                              Kantor, Mrs. Sinai (Miriam Sternin)
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## 319                                          Wick, Miss. Mary Natalie
## 320            Spedden, Mrs. Frederic Oakley (Margaretta Corning Stone)
## 324             Caldwell, Mrs. Albert Francis (Sylvia Mae Harbaugh)
## 326                                          Young, Miss. Marie Grice
## 328                                          Ball, Mrs. (Ada E Hall)
## 329              Goldsmith, Mrs. Frank John (Emily Alice Brown)
## 335            Frauenthal, Mrs. Henry William (Clara Heinsheimer)
## 338                                Burns, Miss. Elizabeth Margaret
## 341                                Navratil, Master. Edmond Roger
## 342                                Fortune, Miss. Alice Elizabeth
## 347                                    Smith, Miss. Marion Elsie
## 348                  Davison, Mrs. Thomas Henry (Mary E Finck)
## 357                                    Bowerman, Miss. Elsie Edith
## 359                                      McGovern, Miss. Mary
## 360                              Mockler, Miss. Helen Mary "Ellie"
## 367              Warren, Mrs. Frank Manley (Anna Sophia Atkinson)
## 368                                Moussa, Mrs. (Mantoura Boulos)
## 371                                Harder, Mr. George Achilles
## 376                    Meyer, Mrs. Edgar Joseph (Leila Saks)
## 377                                Landergren, Miss. Aurora Adelia
## 382                                Nakid, Miss. Maria ("Mary")
## 388                                          Buss, Miss. Kate
## 391                                Carter, Mr. William Ernest
## 392                                Jansson, Mr. Carl Olof
## 394                                Newell, Miss. Marjorie
## 395              Sandstrom, Mrs. Hjalmar (Agnes Charlotta Bengtsson)
## 400                              Trout, Mrs. William H (Jessie L)
## 401                                      Niskanen, Mr. Juha
## 408                              Richards, Master. William Rowe
## 413                                      Minahan, Miss. Daisy E
## 417                  Drew, Mrs. James Vivian (Lulu Thorne Christian)
## 418                                Silven, Miss. Lyyli Karoliina
## 427                  Clarke, Mrs. Charles V (Ada Maria Winfield)
## 431                    Bjornstrom-Steffansson, Mr. Mauritz Hakan
## 432            Thorneycroft, Mrs. Percival (Florence Kate White)
## 433            Louch, Mrs. Charles Alexander (Alice Adelaide Slow)
## 436                                Carter, Miss. Lucile Polk
## 438                      Richards, Mrs. Sidney (Emily Hocking)
## 441                  Hart, Mrs. Benjamin (Esther Ada Bloomfield)
## 444                                Reynaldo, Ms. Encarnacion
## 445                      Johannesen-Bratthammer, Mr. Bernt
## 447                      Mellinger, Miss. Madeleine Violet
## 448                                Seward, Mr. Frederic Kimber
## 449                                Baclini, Miss. Marie Catherine
## 450                                Peuchen, Major. Arthur Godfrey
## 456                                          Jalsevac, Mr. Ivan
## 458                        Kenyon, Mrs. Frederick R (Marion)
## 459                                          Toomey, Miss. Ellen
## 470                                Baclini, Miss. Helene Barbara
## 473                      West, Mrs. Edwy Arthur (Ada Mary Worth)
## 474            Jerwan, Mrs. Amin S (Marie Marthe Thuillard)
## 484                                Turkula, Mrs. (Hedwig)
## 490                              Coutts, Master. Eden Leslie "Neville"
## 497                                Eustis, Miss. Elizabeth Mussey
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## 505                                                Maioni, Miss. Roberta
## 507                       Quick, Mrs. Frederick Charles (Jane Richards)
## 510                                                     Lang, Mr. Fang
## 511                                            Daly, Mr. Eugene Patrick
## 513                                          McGough, Mr. James Robert
## 517                                       Lemore, Mrs. (Amelia Milley)
## 521                                            Perreault, Miss. Anne
## 524                     Hippach, Mrs. Louis Albert (Ida Sophia Fischer)
## 527                                              Ridsdale, Miss. Lucy
## 534                          Peter, Mrs. Catherine (Catherine Rizk)
## 536                                          Hart, Miss. Eva Miriam
## 538                                             LeRoy, Miss. Bertha
## 540                            Frolicher, Miss. Hedwig Margaritha
## 544                                              Beane, Mr. Edward
## 547                              Beane, Mrs. Edward (Ethel Clarke)
## 550                              Davies, Master. John Morgan Jr
## 551                                 Thayer, Mr. John Borland Jr
## 554                          Leeni, Mr. Fahim ("Philip Zenni")
## 555                                            Ohman, Miss. Velin
## 557      Duff Gordon, Lady. (Lucille Christiana Sutherland) ("Mrs Morgan")
## 559                          Taussig, Mrs. Emil (Tillie Mandelbaum)
## 560                   de Messemaeker, Mrs. Guillaume Joseph (Emma)
## 570                                            Jonsson, Mr. Carl
## 571                                            Harris, Mr. George
## 572                      Appleton, Mrs. Edward Dale (Charlotte Lamson)
## 574                                            Kelly, Miss. Mary
## 577                                          Garside, Miss. Ethel
## 580                                          Jussila, Mr. Eiriik
## 581                                  Christy, Miss. Julie Rachel
## 582                 Thayer, Mrs. John Borland (Marian Longstreth Morris)
## 586                                          Taussig, Miss. Ruth
## 588                              Frolicher-Stehli, Mr. Maxmillian
## 592                    Stephenson, Mrs. Walter Bertram (Martha Eustis)
## 597                                    Leitch, Miss. Jessie Wills
## 600                      Duff Gordon, Sir. Cosmo Edmund ("Mr Morgan")
## 601               Jacobsohn, Mrs. Sidney Samuel (Amy Frances Christy)
## 608                                  Daniel, Mr. Robert Williams
## 609         Laroche, Mrs. Joseph (Juliette Marie Louise Lafargue)
## 610                                    Shutes, Miss. Elizabeth W
## 613                                  Murphy, Miss. Margaret Jane
## 616                                          Herman, Miss. Alice
## 619                                  Becker, Miss. Marion Louise
## 623                                            Nakid, Mr. Sahid
## 628                              Longley, Miss. Gretchen Fiske
## 631                        Barkworth, Mr. Algernon Henry Wilson
## 636                                            Davis, Miss. Mary
## 642                                          Sagesser, Mlle. Emma
## 645                                      Baclini, Miss. Eugenie
## 646                                    Harper, Mr. Henry Sleeper
## 648                          Simonius-Blumer, Col. Oberst Alfons
## 650                              Stanley, Miss. Amy Zillah Elsie
## 654                                  O'Leary, Miss. Hanora "Norah"
## 661                              Frauenthal, Dr. Henry William
## 665                              Lindqvist, Mr. Eino William
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## 674                                            Wilhelms, Mr. Charles
## 678                                          Turja, Miss. Anna Sofia
## 680                                 Cardeza, Mr. Thomas Drake Martinez
## 682                                            Hassab, Mr. Hammad
## 690                                 Madill, Miss. Georgette Alexandra
## 692                                            Karun, Miss. Manca
## 693                                                  Lam, Mr. Ali
## 711                    Mayne, Mlle. Berthe Antonine ("Mrs de Villiers")
## 717                                        Endres, Miss. Caroline Louise
## 721                                      Harper, Miss. Annie Jessie "Nina"
## 725                                        Chambers, Mr. Norman Campbell
## 727                             Renouf, Mrs. Peter Henry (Lillian Jefferys)
## 728                                          Mannion, Miss. Margareth
## 731                                       Allen, Miss. Elisabeth Walton
## 738                                            Lesurer, Mr. Gustave J
## 741                                        Hawksford, Mr. Walter James
## 743                             Ryerson, Miss. Susan Parker "Suzette"
## 745                                              Stranden, Mr. Juho
## 748                                            Sinkkonen, Miss. Anna
## 752                                            Moor, Master. Meier
## 760                    Rothes, the Countess. of (Lucy Noel Martha Dyer-Edwards)
## 763                                            Barah, Mr. Hanna Assi
## 778                                       Emanuel, Miss. Virginia Ethel
## 780                    Robert, Mrs. Edward Scott (Elisabeth Walton McMillan)
## 781                                            Ayoub, Miss. Banoura
## 787                                        Sjoblom, Miss. Anna Sofia
## 802                             Collyer, Mrs. Harvey (Charlotte Annie Tate)
## 803                                     Carter, Master. William Thornton II
## 804                                       Thomas, Master. Assad Alexander
## 805                                            Hedman, Mr. Oskar Arvid
## 810                     Chambers, Mrs. Norman Campbell (Bertha Griggs)
## 821                     Hays, Mrs. Charles Melville (Clara Jennings Gregg)
## 822                                              Lulic, Mr. Nikola
## 824                                              Moor, Mrs. (Beila)
## 828                                           Mallet, Master. Andre
## 829                                        McCormack, Mr. Thomas Joseph
## 830                             Stone, Mrs. George Nelson (Martha Evelyn)
## 832                                       Richards, Master. George Sibley
## 836                                       Compton, Miss. Sara Rebecca
## 839                                                  Chip, Mr. Chang
## 843                                           Serepeca, Miss. Augusta
## 850                             Goldenberg, Mrs. Samuel L (Edwiga Grabowska)
## 857                             Wick, Mrs. George Dennick (Mary Hitchcock)
## 858                                              Daly, Mr. Peter Denis
## 859                                    Baclini, Mrs. Solomon (Latifa Qurban)
## 863                     Swift, Mrs. Frederick Joel (Margaret Welles Barron)
## 872                     Beckwith, Mrs. Richard Leonard (Sallie Monypeny)
## 875                                 Abelson, Mrs. Samuel (Hannah Wizosky)
## 880                     Potter, Mrs. Thomas Jr (Lily Alexenia Wilson)
## 888                                        Graham, Miss. Margaret Edith
## 890                                              Behr, Mr. Karl Howell
##          sex   age sib_sp parch         ticket     fare          cabin
## 6       male    NA      0     0         330877   8.4583          <NA>
## 7       male 54.00      0     0          17463  51.8625           E46
```

25

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## 8    male  2.00     3    1           349909  21.0750         <NA>
## 13   male 20.00     0    0         A/5. 2151   8.0500         <NA>
## 14   male 39.00     1    5           347082  31.2750         <NA>
## 15 female 14.00     0    0           350406   7.8542         <NA>
## 17   male  2.00     4    1           382652  29.1250         <NA>
## 19 female 31.00     1    0           345763  18.0000         <NA>
## 21   male 35.00     0    0           239865  26.0000         <NA>
## 28   male 19.00     3    2            19950 263.0000   C23 C25 C27
## 31   male 40.00     0    0         PC 17601  27.7208         <NA>
## 34   male 66.00     0    0       C.A. 24579  10.5000         <NA>
## 35   male 28.00     1    0         PC 17604  82.1708         <NA>
## 36   male 42.00     1    0           113789  52.0000         <NA>
## 38   male 21.00     0    0        A./5. 2152   8.0500         <NA>
## 39 female 18.00     2    0           345764  18.0000         <NA>
## 42 female 27.00     1    0            11668  21.0000         <NA>
## 43   male    NA     0    0           349253   7.8958         <NA>
## 47   male    NA     1    0           370371  15.5000         <NA>
## 58   male 28.50     0    0             2697   7.2292         <NA>
## 60   male 11.00     5    2          CA 2144  46.9000         <NA>
## 61   male 22.00     0    0             2669   7.2292         <NA>
## 63   male 45.00     1    0            36973  83.4750          C83
## 64   male  4.00     3    2           347088  27.9000         <NA>
## 71   male 32.00     0    0       C.A. 33111  10.5000         <NA>
## 72 female 16.00     5    2          CA 2144  46.9000         <NA>
## 81   male 22.00     0    0           345767   9.0000         <NA>
## 84   male 28.00     0    0           113059  47.1000         <NA>
## 87   male 16.00     1    3        W./C. 6608  34.3750         <NA>
## 88   male    NA     0    0   SOTON/OQ 392086   8.0500         <NA>
## 90   male 24.00     0    0           343275   8.0500         <NA>
## 92   male 20.00     0    0           347466   7.8542         <NA>
## 94   male 26.00     1    2        C.A. 2315  20.5750         <NA>
## 95   male 59.00     0    0           364500   7.2500         <NA>
## 96   male    NA     0    0           374910   8.0500         <NA>
## 101 female 28.00     0    0           349245   7.8958         <NA>
## 102   male    NA     0    0           349215   7.8958         <NA>
## 104   male 33.00     0    0             7540   8.6542         <NA>
## 109   male 38.00     0    0           349249   7.8958         <NA>
## 111   male 47.00     0    0           110465  52.0000         C110
## 112 female 14.50     1    0             2665  14.4542         <NA>
## 114 female 20.00     1    0             4136   9.8250         <NA>
## 115 female 17.00     0    0             2627  14.4583         <NA>
## 116   male 21.00     0    0 STON/O 2. 3101294   7.9250         <NA>
## 117   male 70.50     0    0           370369   7.7500         <NA>
## 118   male 29.00     1    0            11668  21.0000         <NA>
## 119   male 24.00     0    1         PC 17558 247.5208      B58 B60
## 120 female  2.00     4    2           347082  31.2750         <NA>
## 123   male 32.50     1    0           237736  30.0708         <NA>
## 125   male 54.00     0    1            35281  77.2875          D26
## 127   male    NA     0    0           370372   7.7500         <NA>
## 130   male 45.00     0    0           347061   6.9750         <NA>
## 131   male 33.00     0    0           349241   7.8958         <NA>
## 132   male 20.00     0    0 SOTON/O.Q. 3101307   7.0500         <NA>
## 133 female 47.00     1    0         A/5. 3337  14.5000         <NA>
## 135   male 25.00     0    0       C.A. 29178  13.0000         <NA>
```

```
## 136   male 23.00    0    0     SC/PARIS 2133  15.0458         <NA>
## 138   male 37.00    1    0          113803  53.1000         C123
## 139   male 16.00    0    0            7534   9.2167         <NA>
## 140   male 24.00    0    0        PC 17593  79.2000          B86
## 141 female    NA    0    2            2678  15.2458         <NA>
## 144   male 19.00    0    0          365222   6.7500         <NA>
## 146   male 19.00    1    1       C.A. 33112  36.7500         <NA>
## 148 female  9.00    2    2        W./C. 6608  34.3750         <NA>
## 149   male 36.50    0    2          230080  26.0000           F2
## 151   male 51.00    0    0      S.O.P. 1166  12.5250         <NA>
## 153   male 55.50    0    0       A.5. 11206   8.0500         <NA>
## 154   male 40.50    0    2         A/5. 851  14.5000         <NA>
## 156   male 51.00    0    1        PC 17597  61.3792         <NA>
## 158   male 30.00    0    0   SOTON/OQ 392090   8.0500         <NA>
## 160   male    NA    8    2         CA. 2343  69.5500         <NA>
## 164   male 17.00    0    0          315093   8.6625         <NA>
## 165   male  1.00    4    1         3101295  39.6875         <NA>
## 169   male    NA    0    0        PC 17318  25.9250         <NA>
## 170   male 28.00    0    0            1601  56.4958         <NA>
## 171   male 61.00    0    0          111240  33.5000          B19
## 172   male  4.00    4    1          382652  29.1250         <NA>
## 174   male 21.00    0    0   STON/O 2. 3101280   7.9250         <NA>
## 175   male 56.00    0    0           17764  30.6958           A7
## 181 female    NA    8    2         CA. 2343  69.5500         <NA>
## 182   male    NA    0    0     SC/PARIS 2131  15.0500         <NA>
## 186   male    NA    0    0          113767  50.0000          A32
## 189   male 40.00    1    1          364849  15.5000         <NA>
## 190   male 36.00    0    0          349247   7.8958         <NA>
## 192   male 19.00    0    0           28424  13.0000         <NA>
## 198   male 42.00    0    1            4579   8.4042         <NA>
## 200 female 24.00    0    0          248747  13.0000         <NA>
## 201   male 28.00    0    0          345770   9.5000         <NA>
## 202   male    NA    8    2         CA. 2343  69.5500         <NA>
## 203   male 34.00    0    0         3101264   6.4958         <NA>
## 206 female  2.00    0    1          347054  10.4625           G6
## 207   male 32.00    1    0         3101278  15.8500         <NA>
## 211   male 24.00    0    0 SOTON/O.Q. 3101311   7.0500         <NA>
## 213   male 22.00    0    0        A/5 21174   7.2500         <NA>
## 215   male    NA    1    0          367229   7.7500         <NA>
## 222   male 27.00    0    0          220367  13.0000         <NA>
## 223   male 51.00    0    0           21440   8.0500         <NA>
## 224   male    NA    0    0          349234   7.8958         <NA>
## 226   male 22.00    0    0         PP 4348   9.3500         <NA>
## 228   male 20.50    0    0        A/5 21173   7.2500         <NA>
## 230 female    NA    3    1            4133  25.4667         <NA>
## 233   male 59.00    0    0          237442  13.5000         <NA>
## 235   male 24.00    0    0       C.A. 29566  10.5000         <NA>
## 239   male 19.00    0    0           28665  10.5000         <NA>
## 240   male 33.00    0    0        SCO/W 1585  12.2750         <NA>
## 241 female    NA    1    0            2665  14.4542         <NA>
## 245   male 30.00    0    0            2694   7.2250         <NA>
## 246   male 44.00    2    0           19928  90.0000          C78
## 247 female 25.00    0    0          347071   7.7750         <NA>
## 250   male 54.00    1    0          244252  26.0000         <NA>
```

```
## 251   male   NA     0   0         362316   7.2500        <NA>
## 252 female 29.00    1   1         347054  10.4625          G6
## 254   male 30.00    1   0      A/5. 3336  16.1000        <NA>
## 261   male   NA     0   0         384461   7.7500        <NA>
## 264   male 40.00    0   0         112059   0.0000         B94
## 265 female   NA     0   0         382649   7.7500        <NA>
## 267   male 16.00    4   1        3101295  39.6875        <NA>
## 274   male 37.00    0   1       PC 17596  29.7000        C118
## 277 female 45.00    0   0         347073   7.7500        <NA>
## 278   male   NA     0   0         239853   0.0000        <NA>
## 279   male  7.00    4   1         382652  29.1250        <NA>
## 281   male 65.00    0   0         336439   7.7500        <NA>
## 282   male 28.00    0   0         347464   7.8542        <NA>
## 283   male 16.00    0   0         345778   9.5000        <NA>
## 285   male   NA     0   0         113056  26.0000         A19
## 293   male 36.00    0   0   SC/Paris 2163  12.8750           D
## 294 female 24.00    0   0         349236   8.8500        <NA>
## 295   male 24.00    0   0         349233   7.8958        <NA>
## 305   male   NA     0   0       A/5 2466   8.0500        <NA>
## 313 female 26.00    1   1         250651  26.0000        <NA>
## 314   male 28.00    0   0         349243   7.8958        <NA>
## 321   male 22.00    0   0      A/5 21172   7.2500        <NA>
## 322   male 27.00    0   0         349219   7.8958        <NA>
## 325   male   NA     8   2        CA. 2343  69.5500        <NA>
## 327   male 61.00    0   0         345364   6.2375        <NA>
## 332   male 45.50    0   0         113043  28.5000        C124
## 333   male 38.00    0   1       PC 17582 153.4625         C91
## 334   male 16.00    2   0         345764  18.0000        <NA>
## 343   male 28.00    0   0         248740  13.0000        <NA>
## 344   male 25.00    0   0         244361  13.0000        <NA>
## 353   male 15.00    1   1           2695   7.2292        <NA>
## 354   male 25.00    1   0         349237  17.8000        <NA>
## 358 female 38.00    0   0         237671  13.0000        <NA>
## 361   male 40.00    1   4         347088  27.9000        <NA>
## 362   male 29.00    1   0   SC/PARIS 2167  27.7208        <NA>
## 363 female 45.00    0   1           2691  14.4542        <NA>
## 364   male 35.00    0   0 SOTON/O.Q. 3101310   7.0500    <NA>
## 366   male 30.00    0   0         C 7076   7.2500        <NA>
## 373   male 19.00    0   0         323951   8.0500        <NA>
## 374   male 22.00    0   0       PC 17760 135.6333        <NA>
## 375 female  3.00    3   1         349909  21.0750        <NA>
## 378   male 27.00    0   2         113503 211.5000         C82
## 379   male 20.00    0   0           2648   4.0125        <NA>
## 380   male 19.00    0   0         347069   7.7750        <NA>
## 387   male  1.00    5   2        CA 2144  46.9000        <NA>
## 389   male   NA     0   0         367655   7.7292        <NA>
## 393   male 28.00    2   0        3101277   7.9250        <NA>
## 396   male 22.00    0   0         350052   7.7958        <NA>
## 397 female 31.00    0   0         350407   7.8542        <NA>
## 398   male 46.00    0   0          28403  26.0000        <NA>
## 399   male 23.00    0   0         244278  10.5000        <NA>
## 402   male 26.00    0   0         341826   8.0500        <NA>
## 403 female 21.00    1   0           4137   9.8250        <NA>
## 404   male 28.00    1   0   STON/O2. 3101279  15.8500    <NA>
```

```
## 405 female 20.00      0      0         315096   8.6625         <NA>
## 407   male 51.00      0      0         347064   7.7500         <NA>
## 409   male 21.00      0      0         312992   7.7750         <NA>
## 410 female    NA      3      1           4133  25.4667         <NA>
## 411   male    NA      0      0         349222   7.8958         <NA>
## 414   male    NA      0      0         239853   0.0000         <NA>
## 416 female    NA      0      0         343095   8.0500         <NA>
## 419   male 30.00      0      0          28228  13.0000         <NA>
## 420 female 10.00      0      2         345773  24.1500         <NA>
## 421   male    NA      0      0         349254   7.8958         <NA>
## 422   male 21.00      0      0     A/5. 13032   7.7333         <NA>
## 423   male 29.00      0      0         315082   7.8750         <NA>
## 424 female 28.00      1      1         347080  14.4000         <NA>
## 426   male    NA      0      0     A/4. 34244   7.2500         <NA>
## 429   male    NA      0      0         364851   7.7500         <NA>
## 434   male 17.00      0      0 STON/O 2. 3101274   7.1250         <NA>
## 435   male 50.00      1      0          13507  55.9000          E44
## 437 female 21.00      2      2     W./C. 6608  34.3750         <NA>
## 440   male 31.00      0      0    C.A. 18723  10.5000         <NA>
## 443   male 25.00      1      0         347076   7.7750         <NA>
## 451   male 36.00      1      2    C.A. 34651  27.7500         <NA>
## 452   male    NA      1      0          65303  19.9667         <NA>
## 453   male 30.00      0      0         113051  27.7500         C111
## 455   male    NA      0      0       A/5 2817   8.0500         <NA>
## 457   male 65.00      0      0          13509  26.5500          E38
## 460   male    NA      0      0         371060   7.7500         <NA>
## 462   male 34.00      0      0         364506   8.0500         <NA>
## 463   male 47.00      0      0         111320  38.5000          E63
## 464   male 48.00      0      0         234360  13.0000         <NA>
## 466   male 38.00      0      0 SOTON/O.Q. 3101306   7.0500         <NA>
## 468   male 56.00      0      0         113792  26.5500         <NA>
## 469   male    NA      0      0          36209   7.7250         <NA>
## 471   male    NA      0      0         323592   7.2500         <NA>
## 472   male 38.00      0      0         315089   8.6625         <NA>
## 475 female 22.00      0      0           7553   9.8375         <NA>
## 476   male    NA      0      0         110465  52.0000          A14
## 478   male 29.00      1      0           3460   7.0458         <NA>
## 479   male 22.00      0      0         350060   7.5208         <NA>
## 481   male  9.00      5      2        CA 2144  46.9000         <NA>
## 482   male    NA      0      0         239854   0.0000         <NA>
## 483   male 50.00      0      0       A/5 3594   8.0500         <NA>
## 486 female    NA      3      1           4133  25.4667         <NA>
## 488   male 58.00      0      0          11771  29.7000          B37
## 493   male 55.00      0      0         113787  30.5000          C30
## 494   male 71.00      0      0       PC 17609  49.5042         <NA>
## 495   male 21.00      0      0       A/4 45380   8.0500         <NA>
## 496   male    NA      0      0           2627  14.4583         <NA>
## 499 female 25.00      1      2         113781 151.5500      C22 C26
## 500   male 24.00      0      0         350035   7.7958         <NA>
## 501   male 17.00      0      0         315086   8.6625         <NA>
## 502 female 21.00      0      0         364846   7.7500         <NA>
## 503 female    NA      0      0         330909   7.6292         <NA>
## 504 female 37.00      0      0           4135   9.5875         <NA>
## 512   male    NA      0      0 SOTON/OQ 3101316   8.0500         <NA>
```

```
## 515    male 24.00    0    0         349209    7.4958         <NA>
## 516    male 47.00    0    0          36967   34.0208         D46
## 518    male    NA    0    0         371110   24.1500         <NA>
## 522    male 22.00    0    0         349252    7.8958         <NA>
## 523    male    NA    0    0           2624    7.2250         <NA>
## 525    male    NA    0    0           2700    7.2292         <NA>
## 528    male    NA    0    0       PC 17483  221.7792         C95
## 530    male 23.00    2    1          29104   11.5000         <NA>
## 532    male    NA    0    0           2641    7.2292         <NA>
## 542 female  9.00    4    2         347082   31.2750         <NA>
## 545    male 50.00    1    0       PC 17761  106.4250         C86
## 549    male 33.00    1    1         363291   20.5250         <NA>
## 553    male    NA    0    0         330979    7.8292         <NA>
## 556    male 62.00    0    0         113807   26.5500         <NA>
## 558    male    NA    0    0       PC 17757  227.5250         <NA>
## 561    male    NA    0    0         372622    7.7500         <NA>
## 562    male 40.00    0    0         349251    7.8958         <NA>
## 563    male 28.00    0    0         218629   13.5000         <NA>
## 564    male    NA    0    0  SOTON/OQ 392082    8.0500         <NA>
## 566    male 24.00    2    0       A/4 48871   24.1500         <NA>
## 567    male 19.00    0    0         349205    7.8958         <NA>
## 568 female 29.00    0    4         349909   21.0750         <NA>
## 569    male    NA    0    0           2686    7.2292         <NA>
## 575    male 16.00    0    0      A/4. 20589    8.0500         <NA>
## 576    male 19.00    0    0         358585   14.5000         <NA>
## 583    male 54.00    0    0          28403   26.0000         <NA>
## 584    male 36.00    0    0          13049   40.1250         A10
## 585    male    NA    0    0           3411    8.7125         <NA>
## 587    male 47.00    0    0         237565   15.0000         <NA>
## 590    male    NA    0    0      A./5. 3235    8.0500         <NA>
## 593    male 47.00    0    0        A/5 3902    7.2500         <NA>
## 594 female    NA    0    2         364848    7.7500         <NA>
## 595    male 37.00    1    0    SC/AH 29037   26.0000         <NA>
## 596    male 36.00    1    1         345773   24.1500         <NA>
## 598    male 49.00    0    0           LINE    0.0000         <NA>
## 599    male    NA    0    0           2664    7.2250         <NA>
## 602    male    NA    0    0         349214    7.8958         <NA>
## 603    male    NA    0    0         113796   42.4000         <NA>
## 604    male 44.00    0    0         364511    8.0500         <NA>
## 606    male 36.00    1    0         349910   15.5500         <NA>
## 607    male 30.00    0    0         349246    7.8958         <NA>
## 617    male 34.00    1    1         347080   14.4000         <NA>
## 618 female 26.00    1    0       A/5. 3336   16.1000         <NA>
## 621    male 27.00    1    0           2659   14.4542         <NA>
## 624    male 21.00    0    0         350029    7.8542         <NA>
## 625    male 21.00    0    0          54636   16.1000         <NA>
## 626    male 61.00    0    0          36963   32.3208         D50
## 627    male 57.00    0    0         219533   12.3500         <NA>
## 629    male 26.00    0    0         349224    7.8958         <NA>
## 630    male    NA    0    0         334912    7.7333         <NA>
## 637    male 32.00    0    0  STON/O 2. 3101292    7.9250         <NA>
## 638    male 31.00    1    1      C.A. 31921   26.2500         <NA>
## 639 female 41.00    0    5         3101295   39.6875         <NA>
## 640    male    NA    1    0         376564   16.1000         <NA>
```

```
## 641   male 20.00    0    0          350050   7.8542         <NA>
## 643 female  2.00    3    2          347088  27.9000         <NA>
## 647   male 19.00    0    0          349231   7.8958         <NA>
## 649   male    NA    0    0    S.O./P.P. 751   7.5500         <NA>
## 653   male 21.00    0    0            8475   8.4333         <NA>
## 656   male 24.00    2    0    S.O.C. 14879  73.5000         <NA>
## 657   male    NA    0    0          349223   7.8958         <NA>
## 659   male 23.00    0    0           29751  13.0000         <NA>
## 662   male 40.00    0    0            2623   7.2250         <NA>
## 664   male 36.00    0    0          349210   7.4958         <NA>
## 667   male 25.00    0    0          234686  13.0000         <NA>
## 668   male    NA    0    0          312993   7.7750         <NA>
## 669   male 43.00    0    0         A/5 3536   8.0500         <NA>
## 672   male 31.00    1    0       F.C. 12750  52.0000          B71
## 675   male    NA    0    0          239856   0.0000         <NA>
## 677   male 24.50    0    0          342826   8.0500         <NA>
## 679 female 43.00    1    6          CA 2144  46.9000         <NA>
## 681 female    NA    0    0          330935   8.1375         <NA>
## 683   male 20.00    0    0            6563   9.2250         <NA>
## 684   male 14.00    5    2          CA 2144  46.9000         <NA>
## 687   male 14.00    4    1          3101295  39.6875         <NA>
## 689   male 18.00    0    0          350036   7.7958         <NA>
## 694   male 25.00    0    0            2672   7.2250         <NA>
## 695   male 60.00    0    0          113800  26.5500         <NA>
## 696   male 52.00    0    0          248731  13.5000         <NA>
## 697   male 44.00    0    0          363592   8.0500         <NA>
## 699   male 49.00    1    1           17421 110.8833          C68
## 700   male 42.00    0    0          348121   7.6500        F G63
## 705   male 26.00    1    0          350025   7.8542         <NA>
## 712   male    NA    0    0          113028  26.5500         C124
## 714   male 29.00    0    0            7545   9.4833         <NA>
## 715   male 52.00    0    0          250647  13.0000         <NA>
## 716   male 19.00    0    0          348124   7.6500        F G73
## 719   male    NA    0    0           36568  15.5000         <NA>
## 723   male 34.00    0    0           12233  13.0000         <NA>
## 726   male 20.00    0    0          315094   8.6625         <NA>
## 729   male 25.00    1    0          236853  26.0000         <NA>
## 730 female 25.00    1    0  STON/O2. 3101271   7.9250        <NA>
## 732   male 11.00    0    0            2699  18.7875         <NA>
## 733   male    NA    0    0          239855   0.0000         <NA>
## 734   male 23.00    0    0           28425  13.0000         <NA>
## 735   male 23.00    0    0          233639  13.0000         <NA>
## 736   male 28.50    0    0           54636  16.1000         <NA>
## 737 female 48.00    1    3         W./C. 6608  34.3750       <NA>
## 740   male    NA    0    0          349218   7.8958         <NA>
## 742   male 36.00    1    0           19877  78.8500          C46
## 744   male 24.00    1    0          376566  16.1000         <NA>
## 746   male 70.00    1    1         WE/P 5735  71.0000          B22
## 747   male 16.00    1    1        C.A. 2673  20.2500         <NA>
## 749   male 19.00    1    0          113773  53.1000          D30
## 750   male 31.00    0    0          335097   7.7500         <NA>
## 754   male 23.00    0    0          349204   7.8958         <NA>
## 757   male 28.00    0    0          350042   7.7958         <NA>
## 758   male 18.00    0    0           29108  11.5000         <NA>
```

31

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## 759   male 34.00      0      0            363294   8.0500            <NA>
## 761   male    NA      0      0            358585  14.5000            <NA>
## 762   male 41.00      0      0   SOTON/O2 3101272   7.1250            <NA>
## 767   male    NA      0      0            112379  39.6000            <NA>
## 770   male 32.00      0      0              8471   8.3625            <NA>
## 773 female 57.00      0      0        S.O./P.P. 3  10.5000             E77
## 774   male    NA      0      0              2674   7.2250            <NA>
## 776   male 18.00      0      0            347078   7.7500            <NA>
## 779   male    NA      0      0             36865   7.7375            <NA>
## 783   male 29.00      0      0            113501  30.0000              D6
## 784   male    NA      1      2         W./C. 6607  23.4500            <NA>
## 791   male    NA      0      0             12460   7.7500            <NA>
## 792   male 16.00      0      0            239865  26.0000            <NA>
## 793 female    NA      8      2           CA. 2343  69.5500            <NA>
## 795   male 25.00      0      0            349203   7.8958            <NA>
## 796   male 39.00      0      0             28213  13.0000            <NA>
## 799   male 30.00      0      0              2685   7.2292            <NA>
## 800 female 30.00      1      1            345773  24.1500            <NA>
## 806   male 31.00      0      0            347063   7.7750            <NA>
## 807   male 39.00      0      0            112050   0.0000             A36
## 809   male 39.00      0      0            248723  13.0000            <NA>
## 811   male 26.00      0      0              3474   7.8875            <NA>
## 812   male 39.00      0      0          A/4 48871  24.1500            <NA>
## 813   male 35.00      0      0             28206  10.5000            <NA>
## 814 female  6.00      4      2            347082  31.2750            <NA>
## 817 female 23.00      0      0   STON/O2. 3101290   7.9250            <NA>
## 818   male 31.00      1      1   S.C./PARIS 2079  37.0042            <NA>
## 819   male 43.00      0      0            C 7075   6.4500            <NA>
## 827   male    NA      0      0              1601  56.4958            <NA>
## 833   male    NA      0      0              2671   7.2292            <NA>
## 834   male 23.00      0      0            347468   7.8542            <NA>
## 835   male 18.00      0      0              2223   8.3000            <NA>
## 837   male 21.00      0      0            315097   8.6625            <NA>
## 841   male 20.00      0      0   SOTON/O2 3101287   7.9250            <NA>
## 842   male 16.00      0      0        S.O./P.P. 3  10.5000            <NA>
## 844   male 34.50      0      0              2683   6.4375            <NA>
## 845   male 17.00      0      0            315090   8.6625            <NA>
## 846   male 42.00      0      0          C.A. 5547   7.5500            <NA>
## 849   male 28.00      0      1            248727  33.0000            <NA>
## 852   male 74.00      0      0            347060   7.7750            <NA>
## 853 female  9.00      1      1              2678  15.2458            <NA>
## 855 female 44.00      1      0            244252  26.0000            <NA>
## 862   male 21.00      1      0             28134  11.5000            <NA>
## 865   male 24.00      0      0            233866  13.0000            <NA>
## 868   male 31.00      0      0          PC 17590  50.4958             A24
## 869   male    NA      0      0            345777   9.5000            <NA>
## 871   male 26.00      0      0            349248   7.8958            <NA>
## 873   male 33.00      0      0               695   5.0000     B51 B53 B55
## 874   male 47.00      0      0            345765   9.0000            <NA>
## 878   male 19.00      0      0            349212   7.8958            <NA>
## 879   male    NA      0      0            349217   7.8958            <NA>
## 882   male 33.00      0      0            349257   7.8958            <NA>
## 883 female 22.00      0      0              7552  10.5167            <NA>
## 885   male 25.00      0      0   SOTON/OQ 392076   7.0500            <NA>
```

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## 886 female 39.00        0    5          382652  29.1250           <NA>
## 887   male 27.00        0    0          211536  13.0000           <NA>
## 889 female    NA        1    2       W./C. 6607  23.4500           <NA>
## 891   male 32.00        0    0          370376   7.7500           <NA>
## 2    female 38.00        1    0         PC 17599  71.2833            C85
## 3    female 26.00        0    0   STON/O2. 3101282   7.9250           <NA>
## 4    female 35.00        1    0          113803  53.1000           C123
## 9    female 27.00        0    2          347742  11.1333           <NA>
## 11   female  4.00        1    1          PP 9549  16.7000             G6
## 16   female 55.00        0    0          248706  16.0000           <NA>
## 24     male 28.00        0    0          113788  35.5000             A6
## 26   female 38.00        1    5          347077  31.3875           <NA>
## 29   female    NA        0    0          330959   7.8792           <NA>
## 32   female    NA        1    0         PC 17569 146.5208            B78
## 33   female    NA        0    0          335677   7.7500           <NA>
## 37     male    NA        0    0            2677   7.2292           <NA>
## 40   female 14.00        1    0            2651  11.2417           <NA>
## 44   female  3.00        1    2    SC/Paris 2123  41.5792           <NA>
## 45   female 19.00        0    0          330958   7.8792           <NA>
## 48   female    NA        0    0           14311   7.7500           <NA>
## 53   female 49.00        1    0         PC 17572  76.7292            D33
## 59   female  5.00        1    2       C.A. 34651  27.7500           <NA>
## 62   female 38.00        0    0          113572  80.0000            B28
## 66     male    NA        1    1            2661  15.2458           <NA>
## 69   female 17.00        4    2          3101281   7.9250           <NA>
## 75     male 32.00        0    0            1601  56.4958           <NA>
## 79     male  0.83        0    2          248738  29.0000           <NA>
## 82     male 29.00        0    0          345779   9.5000           <NA>
## 85   female 17.00        0    0       SO/C 14885  10.5000           <NA>
## 86   female 33.00        3    0          3101278  15.8500           <NA>
## 99   female 34.00        0    1          231919  23.0000           <NA>
## 108    male    NA        0    0          312991   7.7750           <NA>
## 110 female    NA        1    0          371110  24.1500           <NA>
## 124 female 32.50        0    0           27267  13.0000           E101
## 126   male 12.00        1    0            2651  11.2417           <NA>
## 128   male 24.00        0    0         C 17369   7.1417           <NA>
## 129 female    NA        1    1            2668  22.3583          F E69
## 137 female 19.00        0    2           11752  26.2833            D47
## 142 female 22.00        0    0          347081   7.7500           <NA>
## 143 female 24.00        1    0   STON/O2. 3101279  15.8500           <NA>
## 147   male 27.00        0    0          350043   7.7958           <NA>
## 157 female 16.00        0    0           35851   7.7333           <NA>
## 162 female 40.00        0    0       C.A. 33595  15.7500           <NA>
## 167 female    NA        0    1          113505  55.0000            E33
## 173 female  1.00        1    1          347742  11.1333           <NA>
## 184   male  1.00        2    1          230136  39.0000             F4
## 185 female  4.00        0    2          315153  22.0250           <NA>
## 191 female 32.00        0    0          234604  13.0000           <NA>
## 194   male  3.00        1    1          230080  26.0000             F2
## 195 female 44.00        0    0         PC 17610  27.7208             B4
## 196 female 58.00        0    0         PC 17569 146.5208            B80
## 205   male 18.00        0    0        A/5 3540   8.0500           <NA>
## 208   male 26.00        0    0            2699  18.7875           <NA>
## 209 female 16.00        0    0          367231   7.7500           <NA>
```

```
## 210   male 40.00      0      0           112277  31.0000              A31
## 212 female 35.00      0      0    F.C.C. 13528  21.0000              <NA>
## 216 female 31.00      1      0            35273 113.2750              D36
## 217 female 27.00      0      0  STON/O2. 3101283   7.9250            <NA>
## 219 female 32.00      0      0            11813  76.2917              D15
## 221   male 16.00      0      0  SOTON/OQ 392089   8.0500             <NA>
## 225   male 38.00      1      0            19943  90.0000              C93
## 238 female  8.00      0      2    C.A. 31921  26.2500              <NA>
## 242 female    NA      1      0           367230  15.5000            <NA>
## 248 female 24.00      0      2           250649  14.5000            <NA>
## 256 female 29.00      0      2             2650  15.2458            <NA>
## 258 female 30.00      0      0           110152  86.5000              B77
## 260 female 50.00      0      1           230433  26.0000            <NA>
## 262   male  3.00      4      2           347077  31.3875            <NA>
## 268   male 25.00      1      0           347083   7.7750            <NA>
## 273 female 41.00      0      1           250644  19.5000            <NA>
## 276 female 63.00      1      0            13502  77.9583              D7
## 280 female 35.00      1      1    C.A. 2673  20.2500              <NA>
## 290 female 22.00      0      0           370373   7.7500            <NA>
## 291 female 26.00      0      0            19877  78.8500            <NA>
## 299   male    NA      0      0            19988  30.5000             C106
## 300 female 50.00      0      1    PC 17558 247.5208          B58 B60
## 302   male    NA      2      0           367226  23.2500            <NA>
## 304 female    NA      0      0           226593  12.3500             E101
## 306   male  0.92      1      2           113781 151.5500          C22 C26
## 307 female    NA      0      0            17421 110.8833            <NA>
## 308 female 17.00      1      0    PC 17758 108.9000              C65
## 310 female 30.00      0      0    PC 17485  56.9292              E36
## 311 female 24.00      0      0            11767  83.1583              C54
## 317 female 24.00      1      0           244367  26.0000            <NA>
## 319 female 31.00      0      2            36928 164.8667              C7
## 320 female 40.00      1      1            16966 134.5000              E34
## 324 female 22.00      1      1           248738  29.0000            <NA>
## 326 female 36.00      0      0    PC 17760 135.6333              C32
## 328 female 36.00      0      0            28551  13.0000               D
## 329 female 31.00      1      1           363291  20.5250            <NA>
## 335 female    NA      1      0    PC 17611 133.6500            <NA>
## 338 female 41.00      0      0            16966 134.5000              E40
## 341   male  2.00      1      1           230080  26.0000              F2
## 342 female 24.00      3      2            19950 263.0000        C23 C25 C27
## 347 female 40.00      0      0            31418  13.0000            <NA>
## 348 female    NA      1      0           386525  16.1000            <NA>
## 357 female 22.00      0      1           113505  55.0000              E33
## 359 female    NA      0      0           330931   7.8792            <NA>
## 360 female    NA      0      0           330980   7.8792            <NA>
## 367 female 60.00      1      0           110813  75.2500              D37
## 368 female    NA      0      0             2626   7.2292            <NA>
## 371   male 25.00      1      0            11765  55.4417              E50
## 376 female    NA      1      0    PC 17604  82.1708            <NA>
## 377 female 22.00      0      0    C 7077   7.2500              <NA>
## 382 female  1.00      0      2             2653  15.7417            <NA>
## 388 female 36.00      0      0            27849  13.0000            <NA>
## 391   male 36.00      1      2           113760 120.0000          B96 B98
## 392   male 21.00      0      0           350034   7.7958            <NA>
```

```
## 394 female 23.00     1      0              35273 113.2750          D36
## 395 female 24.00     0      2           PP 9549  16.7000           G6
## 400 female 28.00     0      0             240929  12.6500         <NA>
## 401   male 39.00     0      0 STON/O 2. 3101289   7.9250          <NA>
## 408   male  3.00     1      1              29106  18.7500         <NA>
## 413 female 33.00     1      0              19928  90.0000          C78
## 417 female 34.00     1      1              28220  32.5000         <NA>
## 418 female 18.00     0      2             250652  13.0000         <NA>
## 427 female 28.00     1      0               2003  26.0000         <NA>
## 431   male 28.00     0      0             110564  26.5500          C52
## 432 female    NA     1      0             376564  16.1000         <NA>
## 433 female 42.00     1      0          SC/AH 3085 26.0000         <NA>
## 436 female 14.00     1      2             113760 120.0000      B96 B98
## 438 female 24.00     2      3              29106  18.7500         <NA>
## 441 female 45.00     1      1       F.C.C. 13529  26.2500         <NA>
## 444 female 28.00     0      0             230434  13.0000         <NA>
## 445   male    NA     0      0              65306   8.1125         <NA>
## 447 female 13.00     0      1             250644  19.5000         <NA>
## 448   male 34.00     0      0             113794  26.5500         <NA>
## 449 female  5.00     2      1               2666  19.2583         <NA>
## 450   male 52.00     0      0             113786  30.5000         C104
## 456   male 29.00     0      0             349240   7.8958         <NA>
## 458 female    NA     1      0              17464  51.8625          D21
## 459 female 50.00     0      0       F.C.C. 13531  10.5000         <NA>
## 470 female  0.75     2      1               2666  19.2583         <NA>
## 473 female 33.00     1      2        C.A. 34651   27.7500         <NA>
## 474 female 23.00     0      0    SC/AH Basle 541  13.7917            D
## 484 female 63.00     0      0               4134   9.5875         <NA>
## 490   male  9.00     1      1        C.A. 37671   15.9000         <NA>
## 497 female 54.00     1      0              36947  78.2667          D20
## 505 female 16.00     0      0             110152  86.5000          B79
## 507 female 33.00     0      2              26360  26.0000         <NA>
## 510   male 26.00     0      0               1601  56.4958         <NA>
## 511   male 29.00     0      0             382651   7.7500         <NA>
## 513   male 36.00     0      0           PC 17473  26.2875          E25
## 517 female 34.00     0      0        C.A. 34260   10.5000          F33
## 521 female 30.00     0      0              12749  93.5000          B73
## 524 female 44.00     0      1             111361  57.9792          B18
## 527 female 50.00     0      0        W./C. 14258  10.5000         <NA>
## 534 female    NA     0      2               2668  22.3583         <NA>
## 536 female  7.00     0      2       F.C.C. 13529  26.2500         <NA>
## 538 female 30.00     0      0           PC 17761 106.4250         <NA>
## 540 female 22.00     0      2              13568  49.5000          B39
## 544   male 32.00     1      0               2908  26.0000         <NA>
## 547 female 19.00     1      0               2908  26.0000         <NA>
## 550   male  8.00     1      1        C.A. 33112   36.7500         <NA>
## 551   male 17.00     0      2              17421 110.8833          C70
## 554   male 22.00     0      0               2620   7.2250         <NA>
## 555 female 22.00     0      0             347085   7.7750         <NA>
## 557 female 48.00     1      0              11755  39.6000          A16
## 559 female 39.00     1      1             110413  79.6500          E67
## 560 female 36.00     1      0             345572  17.4000         <NA>
## 570   male 32.00     0      0             350417   7.8542         <NA>
## 571   male 62.00     0      0       S.W./PP 752   10.5000         <NA>
```

```
## 572 female 53.00      2      0              11769   51.4792              C101
## 574 female    NA      0      0              14312    7.7500              <NA>
## 577 female 34.00      0      0             243880   13.0000              <NA>
## 580   male 32.00      0      0 STON/O 2. 3101286    7.9250              <NA>
## 581 female 25.00      1      1             237789   30.0000              <NA>
## 582 female 39.00      1      1              17421  110.8833               C68
## 586 female 18.00      0      2             110413   79.6500               E68
## 588   male 60.00      1      1              13567   79.2000               B41
## 592 female 52.00      1      0              36947   78.2667               D20
## 597 female    NA      0      0             248727   33.0000              <NA>
## 600   male 49.00      1      0        PC 17485   56.9292               A20
## 601 female 24.00      2      1             243847   27.0000              <NA>
## 608   male 27.00      0      0             113804   30.5000              <NA>
## 609 female 22.00      1      2     SC/Paris 2123   41.5792              <NA>
## 610 female 40.00      0      0        PC 17582  153.4625              C125
## 613 female    NA      1      0             367230   15.5000              <NA>
## 616 female 24.00      1      2             220845   65.0000              <NA>
## 619 female  4.00      2      1             230136   39.0000                F4
## 623   male 20.00      1      1               2653   15.7417              <NA>
## 628 female 21.00      0      0              13502   77.9583                D9
## 631   male 80.00      0      0              27042   30.0000               A23
## 636 female 28.00      0      0             237668   13.0000              <NA>
## 642 female 24.00      0      0        PC 17477   69.3000               B35
## 645 female  0.75      2      1               2666   19.2583              <NA>
## 646   male 48.00      1      0        PC 17572   76.7292               D33
## 648   male 56.00      0      0              13213   35.5000               A26
## 650 female 23.00      0      0         CA. 2314    7.5500              <NA>
## 654 female    NA      0      0             330919    7.8292              <NA>
## 661   male 50.00      2      0        PC 17611  133.6500              <NA>
## 665   male 20.00      1      0 STON/O 2. 3101285    7.9250              <NA>
## 674   male 31.00      0      0             244270   13.0000              <NA>
## 678 female 18.00      0      0               4138    9.8417              <NA>
## 680   male 36.00      0      1        PC 17755  512.3292       B51 B53 B55
## 682   male 27.00      0      0        PC 17572   76.7292               D49
## 690 female 15.00      0      1              24160  211.3375                B5
## 692 female  4.00      0      1             349256   13.4167              <NA>
## 693   male    NA      0      0               1601   56.4958              <NA>
## 711 female 24.00      0      0        PC 17482   49.5042               C90
## 717 female 38.00      0      0        PC 17757  227.5250               C45
## 721 female  6.00      0      1             248727   33.0000              <NA>
## 725   male 27.00      1      0             113806   53.1000                E8
## 727 female 30.00      3      0              31027   21.0000              <NA>
## 728 female    NA      0      0              36866    7.7375              <NA>
## 731 female 29.00      0      0              24160  211.3375                B5
## 738   male 35.00      0      0        PC 17755  512.3292              B101
## 741   male    NA      0      0              16988   30.0000               D45
## 743 female 21.00      2      2        PC 17608  262.3750 B57 B59 B63 B66
## 745   male 31.00      0      0 STON/O 2. 3101288    7.9250              <NA>
## 748 female 30.00      0      0             250648   13.0000              <NA>
## 752   male  6.00      0      1             392096   12.4750              E121
## 760 female 33.00      0      0             110152   86.5000               B77
## 763   male 20.00      0      0               2663    7.2292              <NA>
## 778 female  5.00      0      0             364516   12.4750              <NA>
## 780 female 43.00      0      1              24160  211.3375                B3
```

```
## 781 female 13.00       0     0         2687   7.2292        <NA>
## 787 female 18.00       0     0      3101265   7.4958        <NA>
## 802 female 31.00       1     1   C.A. 31921  26.2500        <NA>
## 803   male 11.00       1     2       113760 120.0000     B96 B98
## 804   male  0.42       0     1         2625   8.5167        <NA>
## 805   male 27.00       0     0       347089   6.9750        <NA>
## 810 female 33.00       1     0       113806  53.1000          E8
## 821 female 52.00       1     1        12749  93.5000         B69
## 822   male 27.00       0     0       315098   8.6625        <NA>
## 824 female 27.00       0     1       392096  12.4750        E121
## 828   male  1.00       0     2  S.C./PARIS 2079 37.0042     <NA>
## 829   male    NA       0     0       367228   7.7500        <NA>
## 830 female 62.00       0     0       113572  80.0000         B28
## 832   male  0.83       1     1        29106  18.7500        <NA>
## 836 female 39.00       1     1     PC 17756  83.1583         E49
## 839   male 32.00       0     0         1601  56.4958        <NA>
## 843 female 30.00       0     0       113798  31.0000        <NA>
## 850 female    NA       1     0        17453  89.1042         C92
## 857 female 45.00       1     1        36928 164.8667        <NA>
## 858   male 51.00       0     0       113055  26.5500         E17
## 859 female 24.00       0     3         2666  19.2583        <NA>
## 863 female 48.00       0     0        17466  25.9292         D17
## 872 female 47.00       1     1        11751  52.5542         D35
## 875 female 28.00       1     0     P/PP 3381  24.0000        <NA>
## 880 female 56.00       0     1        11767  83.1583         C50
## 888 female 19.00       0     0       112053  30.0000         B42
## 890   male 26.00       0     0       111369  30.0000        C148
##     embarked
## 6          Q
## 7          S
## 8          S
## 13         S
## 14         S
## 15         S
## 17         Q
## 19         S
## 21         S
## 28         S
## 31         C
## 34         S
## 35         C
## 36         S
## 38         S
## 39         S
## 42         S
## 43         C
## 47         Q
## 58         C
## 60         S
## 61         C
## 63         S
## 64         S
## 71         S
## 72         S
```

```
## 81        S
## 84        S
## 87        S
## 88        S
## 90        S
## 92        S
## 94        S
## 95        S
## 96        S
## 101       S
## 102       S
## 104       S
## 109       S
## 111       S
## 112       C
## 114       S
## 115       C
## 116       S
## 117       Q
## 118       S
## 119       C
## 120       S
## 123       C
## 125       S
## 127       Q
## 130       S
## 131       C
## 132       S
## 133       S
## 135       S
## 136       C
## 138       S
## 139       S
## 140       C
## 141       C
## 144       Q
## 146       S
## 148       S
## 149       S
## 151       S
## 153       S
## 154       S
## 156       C
## 158       S
## 160       S
## 164       S
## 165       S
## 169       S
## 170       S
## 171       S
## 172       Q
## 174       S
## 175       C
## 181       S
```

```
## 182          C
## 186          S
## 189          Q
## 190          S
## 192          S
## 198          S
## 200          S
## 201          S
## 202          S
## 203          S
## 206          S
## 207          S
## 211          S
## 213          S
## 215          Q
## 222          S
## 223          S
## 224          S
## 226          S
## 228          S
## 230          S
## 233          S
## 235          S
## 239          S
## 240          S
## 241          C
## 245          C
## 246          Q
## 247          S
## 250          S
## 251          S
## 252          S
## 254          S
## 261          Q
## 264          S
## 265          Q
## 267          S
## 274          C
## 277          S
## 278          S
## 279          Q
## 281          Q
## 282          S
## 283          S
## 285          S
## 293          C
## 294          S
## 295          S
## 305          S
## 313          S
## 314          S
## 321          S
## 322          S
## 325          S
```

```
## 327        S
## 332        S
## 333        S
## 334        S
## 343        S
## 344        S
## 353        C
## 354        S
## 358        S
## 361        S
## 362        C
## 363        C
## 364        S
## 366        S
## 373        S
## 374        C
## 375        S
## 378        C
## 379        C
## 380        S
## 387        S
## 389        Q
## 393        S
## 396        S
## 397        S
## 398        S
## 399        S
## 402        S
## 403        S
## 404        S
## 405        S
## 407        S
## 409        S
## 410        S
## 411        S
## 414        S
## 416        S
## 419        S
## 420        S
## 421        C
## 422        Q
## 423        S
## 424        S
## 426        S
## 429        Q
## 434        S
## 435        S
## 437        S
## 440        S
## 443        S
## 451        S
## 452        S
## 453        C
## 455        S
```

```
## 457       S
## 460       Q
## 462       S
## 463       S
## 464       S
## 466       S
## 468       S
## 469       Q
## 471       S
## 472       S
## 475       S
## 476       S
## 478       S
## 479       S
## 481       S
## 482       S
## 483       S
## 486       S
## 488       C
## 493       S
## 494       C
## 495       S
## 496       C
## 499       S
## 500       S
## 501       S
## 502       Q
## 503       Q
## 504       S
## 512       S
## 515       S
## 516       S
## 518       Q
## 522       S
## 523       C
## 525       C
## 528       S
## 530       S
## 532       C
## 542       S
## 545       C
## 549       S
## 553       Q
## 556       S
## 558       C
## 561       Q
## 562       S
## 563       S
## 564       S
## 566       S
## 567       S
## 568       S
## 569       C
## 575       S
```

```
## 576          S
## 583          S
## 584          C
## 585          C
## 587          S
## 590          S
## 593          S
## 594          Q
## 595          S
## 596          S
## 598          S
## 599          C
## 602          S
## 603          S
## 604          S
## 606          S
## 607          S
## 617          S
## 618          S
## 621          C
## 624          S
## 625          S
## 626          S
## 627          Q
## 629          S
## 630          Q
## 637          S
## 638          S
## 639          S
## 640          S
## 641          S
## 643          S
## 647          S
## 649          S
## 653          S
## 656          S
## 657          S
## 659          S
## 662          C
## 664          S
## 667          S
## 668          S
## 669          S
## 672          S
## 675          S
## 677          S
## 679          S
## 681          Q
## 683          S
## 684          S
## 687          S
## 689          S
## 694          C
## 695          S
```

```
## 696          S
## 697          S
## 699          C
## 700          S
## 705          S
## 712          S
## 714          S
## 715          S
## 716          S
## 719          Q
## 723          S
## 726          S
## 729          S
## 730          S
## 732          C
## 733          S
## 734          S
## 735          S
## 736          S
## 737          S
## 740          S
## 742          S
## 744          S
## 746          S
## 747          S
## 749          S
## 750          Q
## 754          S
## 757          S
## 758          S
## 759          S
## 761          S
## 762          S
## 767          C
## 770          S
## 773          S
## 774          C
## 776          S
## 779          Q
## 783          S
## 784          S
## 791          Q
## 792          S
## 793          S
## 795          S
## 796          S
## 799          C
## 800          S
## 806          S
## 807          S
## 809          S
## 811          S
## 812          S
## 813          S
```

```
## 814            S
## 817            S
## 818            C
## 819            S
## 827            S
## 833            C
## 834            S
## 835            S
## 837            S
## 841            S
## 842            S
## 844            C
## 845            S
## 846            S
## 849            S
## 852            S
## 853            C
## 855            S
## 862            S
## 865            S
## 868            S
## 869            S
## 871            S
## 873            S
## 874            S
## 878            S
## 879            S
## 882            S
## 883            S
## 885            S
## 886            Q
## 887            S
## 889            S
## 891            Q
## 2             C
## 3             S
## 4             S
## 9             S
## 11            S
## 16            S
## 24            S
## 26            S
## 29            Q
## 32            C
## 33            Q
## 37            C
## 40            C
## 44            C
## 45            Q
## 48            Q
## 53            C
## 59            S
## 62          <NA>
## 66            C
```

```
## 69        S
## 75        S
## 79        S
## 82        S
## 85        S
## 86        S
## 99        S
## 108       S
## 110       Q
## 124       S
## 126       C
## 128       S
## 129       C
## 137       S
## 142       S
## 143       S
## 147       S
## 157       Q
## 162       S
## 167       S
## 173       S
## 184       S
## 185       S
## 191       S
## 194       S
## 195       C
## 196       C
## 205       S
## 208       C
## 209       Q
## 210       C
## 212       S
## 216       C
## 217       S
## 219       C
## 221       S
## 225       S
## 238       S
## 242       Q
## 248       S
## 256       C
## 258       S
## 260       S
## 262       S
## 268       S
## 273       S
## 276       S
## 280       S
## 290       Q
## 291       S
## 299       S
## 300       C
## 302       Q
## 304       Q
```

```
## 306        S
## 307        C
## 308        C
## 310        C
## 311        C
## 317        S
## 319        S
## 320        C
## 324        S
## 326        C
## 328        S
## 329        S
## 335        S
## 338        C
## 341        S
## 342        S
## 347        S
## 348        S
## 357        S
## 359        Q
## 360        Q
## 367        C
## 368        C
## 371        C
## 376        C
## 377        S
## 382        C
## 388        S
## 391        S
## 392        S
## 394        C
## 395        S
## 400        S
## 401        S
## 408        S
## 413        Q
## 417        S
## 418        S
## 427        S
## 431        S
## 432        S
## 433        S
## 436        S
## 438        S
## 441        S
## 444        S
## 445        S
## 447        S
## 448        S
## 449        C
## 450        S
## 456        C
## 458        S
## 459        S
```

```
## 470          C
## 473          S
## 474          C
## 484          S
## 490          S
## 497          C
## 505          S
## 507          S
## 510          S
## 511          Q
## 513          S
## 517          S
## 521          S
## 524          C
## 527          S
## 534          C
## 536          S
## 538          C
## 540          C
## 544          S
## 547          S
## 550          S
## 551          C
## 554          C
## 555          S
## 557          C
## 559          S
## 560          S
## 570          S
## 571          S
## 572          S
## 574          Q
## 577          S
## 580          S
## 581          S
## 582          C
## 586          S
## 588          C
## 592          C
## 597          S
## 600          C
## 601          S
## 608          S
## 609          C
## 610          S
## 613          Q
## 616          S
## 619          S
## 623          C
## 628          S
## 631          S
## 636          S
## 642          C
## 645          C
```

```
## 646        C
## 648        C
## 650        S
## 654        Q
## 661        S
## 665        S
## 674        S
## 678        S
## 680        C
## 682        C
## 690        S
## 692        C
## 693        S
## 711        C
## 717        C
## 721        S
## 725        S
## 727        S
## 728        Q
## 731        S
## 738        C
## 741        S
## 743        C
## 745        S
## 748        S
## 752        S
## 760        S
## 763        C
## 778        S
## 780        S
## 781        C
## 787        S
## 802        S
## 803        S
## 804        C
## 805        S
## 810        S
## 821        S
## 822        S
## 824        S
## 828        C
## 829        Q
## 830     <NA>
## 832        S
## 836        C
## 839        S
## 843        C
## 850        C
## 857        S
## 858        S
## 859        C
## 863        S
## 872        S
## 875        C
```

```
## 880         C
## 888         S
## 890         C
```

titanic_test

```
##      passenger_id survived pclass
## 1               1       No      3
## 5               5       No      3
## 10             10      Yes      2
## 12             12      Yes      1
## 18             18      Yes      2
## 20             20      Yes      3
## 22             22      Yes      2
## 23             23      Yes      3
## 25             25       No      3
## 27             27       No      3
## 30             30       No      3
## 41             41       No      3
## 46             46       No      3
## 49             49       No      3
## 50             50       No      3
## 51             51       No      3
## 52             52       No      3
## 54             54      Yes      2
## 55             55       No      1
## 56             56      Yes      1
## 57             57      Yes      2
## 65             65       No      1
## 67             67      Yes      2
## 68             68       No      3
## 70             70       No      3
## 73             73       No      2
## 74             74       No      3
## 76             76       No      3
## 77             77       No      3
## 78             78       No      3
## 80             80      Yes      3
## 83             83      Yes      3
## 89             89      Yes      1
## 91             91       No      3
## 93             93       No      1
## 97             97       No      1
## 98             98      Yes      1
## 100           100       No      2
## 103           103       No      1
## 105           105       No      3
## 106           106       No      3
## 107           107      Yes      3
## 113           113       No      3
## 121           121       No      2
## 122           122       No      3
## 134           134      Yes      2
## 145           145       No      2
```

```
## 150         150        No      2
## 152         152        Yes     1
## 155         155        No      3
## 159         159        No      3
## 161         161        No      3
## 163         163        No      3
## 166         166        Yes     3
## 168         168        No      3
## 176         176        No      3
## 177         177        No      3
## 178         178        No      1
## 179         179        No      2
## 180         180        No      3
## 183         183        No      3
## 187         187        Yes     3
## 188         188        Yes     1
## 193         193        Yes     3
## 197         197        No      3
## 199         199        Yes     3
## 204         204        No      3
## 214         214        No      2
## 218         218        No      2
## 220         220        No      2
## 227         227        Yes     2
## 229         229        No      2
## 231         231        Yes     1
## 232         232        No      3
## 234         234        Yes     3
## 236         236        No      3
## 237         237        No      2
## 243         243        No      2
## 244         244        No      3
## 249         249        Yes     1
## 253         253        No      1
## 255         255        No      3
## 257         257        Yes     1
## 259         259        Yes     1
## 263         263        No      1
## 266         266        No      2
## 269         269        Yes     1
## 270         270        Yes     1
## 271         271        No      1
## 272         272        Yes     3
## 275         275        Yes     3
## 284         284        Yes     3
## 286         286        No      3
## 287         287        Yes     3
## 288         288        No      3
## 289         289        Yes     2
## 292         292        Yes     1
## 296         296        No      1
## 297         297        No      3
## 298         298        No      1
## 301         301        Yes     3
```

```
## 303      303      No      3
## 309      309      No      2
## 312      312      Yes     1
## 315      315      No      2
## 316      316      Yes     3
## 318      318      No      2
## 323      323      Yes     2
## 330      330      Yes     1
## 331      331      Yes     3
## 336      336      No      3
## 337      337      No      1
## 339      339      Yes     3
## 340      340      No      1
## 345      345      No      2
## 346      346      Yes     2
## 349      349      Yes     3
## 350      350      No      3
## 351      351      No      3
## 352      352      No      1
## 355      355      No      3
## 356      356      No      3
## 365      365      No      3
## 369      369      Yes     3
## 370      370      Yes     1
## 372      372      No      3
## 381      381      Yes     1
## 383      383      No      3
## 384      384      Yes     1
## 385      385      No      3
## 386      386      No      2
## 390      390      Yes     2
## 406      406      No      2
## 412      412      No      3
## 415      415      Yes     3
## 425      425      No      3
## 428      428      Yes     2
## 430      430      Yes     3
## 439      439      No      1
## 442      442      No      3
## 446      446      Yes     1
## 454      454      Yes     1
## 461      461      Yes     1
## 465      465      No      3
## 467      467      No      2
## 477      477      No      2
## 480      480      Yes     3
## 485      485      Yes     1
## 487      487      Yes     1
## 489      489      No      3
## 491      491      No      3
## 492      492      No      3
## 498      498      No      3
## 506      506      No      1
## 508      508      Yes     1
```

```
## 509      509      No    3
## 514      514      Yes   1
## 519      519      Yes   2
## 520      520      No    3
## 526      526      No    3
## 529      529      No    3
## 531      531      Yes   2
## 533      533      No    3
## 535      535      No    3
## 537      537      No    1
## 539      539      No    3
## 541      541      Yes   1
## 543      543      No    3
## 546      546      No    1
## 548      548      Yes   2
## 552      552      No    2
## 565      565      No    3
## 573      573      Yes   1
## 578      578      Yes   1
## 579      579      No    3
## 589      589      No    3
## 591      591      No    3
## 605      605      Yes   1
## 611      611      No    3
## 612      612      No    3
## 614      614      No    3
## 615      615      No    3
## 620      620      No    2
## 622      622      Yes   1
## 632      632      No    3
## 633      633      Yes   1
## 634      634      No    1
## 635      635      No    3
## 644      644      Yes   3
## 651      651      No    3
## 652      652      Yes   2
## 655      655      No    3
## 658      658      No    3
## 660      660      No    1
## 663      663      No    1
## 666      666      No    2
## 670      670      Yes   1
## 671      671      Yes   2
## 673      673      No    2
## 676      676      No    3
## 685      685      No    2
## 686      686      No    2
## 688      688      No    3
## 691      691      Yes   1
## 698      698      Yes   3
## 701      701      Yes   1
## 702      702      Yes   1
## 703      703      No    3
## 704      704      No    3
```

```
## 706        706        No      2
## 707        707        Yes     2
## 708        708        Yes     1
## 709        709        Yes     1
## 710        710        Yes     3
## 713        713        Yes     1
## 718        718        Yes     2
## 720        720        No      3
## 722        722        No      3
## 724        724        No      2
## 739        739        No      3
## 751        751        Yes     2
## 753        753        No      3
## 755        755        Yes     2
## 756        756        Yes     2
## 764        764        Yes     1
## 765        765        No      3
## 766        766        Yes     1
## 768        768        No      3
## 769        769        No      3
## 771        771        No      3
## 772        772        No      3
## 775        775        Yes     2
## 777        777        No      3
## 782        782        Yes     1
## 785        785        No      3
## 786        786        No      3
## 788        788        No      3
## 789        789        Yes     3
## 790        790        No      1
## 794        794        No      1
## 797        797        Yes     1
## 798        798        Yes     3
## 801        801        No      2
## 808        808        No      3
## 815        815        No      3
## 816        816        No      1
## 820        820        No      3
## 823        823        No      1
## 825        825        No      3
## 826        826        No      3
## 831        831        Yes     3
## 838        838        No      3
## 840        840        Yes     1
## 847        847        No      3
## 848        848        No      3
## 851        851        No      3
## 854        854        Yes     1
## 856        856        Yes     3
## 860        860        No      3
## 861        861        No      3
## 864        864        No      3
## 866        866        Yes     2
## 867        867        Yes     2
```

```
## 870           870        Yes       3
## 876           876        Yes       3
## 877           877        No        3
## 881           881        Yes       2
## 884           884        No        2
##                                                               name    sex
## 1                                       Braund, Mr. Owen Harris    male
## 5                                      Allen, Mr. William Henry    male
## 10                     Nasser, Mrs. Nicholas (Adele Achem) female
## 12                             Bonnell, Miss. Elizabeth female
## 18                            Williams, Mr. Charles Eugene    male
## 20                              Masselmani, Mrs. Fatima female
## 22                               Beesley, Mr. Lawrence    male
## 23                            McGowan, Miss. Anna "Annie" female
## 25                         Palsson, Miss. Torborg Danira female
## 27                             Emir, Mr. Farred Chehab    male
## 30                                  Todoroff, Mr. Lalio    male
## 41         Ahlin, Mrs. Johan (Johanna Persdotter Larsson) female
## 46                            Rogers, Mr. William John    male
## 49                              Samaan, Mr. Youssef    male
## 50         Arnold-Franchi, Mrs. Josef (Josefine Franchi) female
## 51                             Panula, Master. Juha Niilo    male
## 52                            Nosworthy, Mr. Richard Cater    male
## 54      Faunthorpe, Mrs. Lizzie (Elizabeth Anne Wilkinson) female
## 55                         Ostby, Mr. Engelhart Cornelius    male
## 56                                  Woolner, Mr. Hugh    male
## 57                                   Rugg, Miss. Emily female
## 65                                Stewart, Mr. Albert A    male
## 67                           Nye, Mrs. (Elizabeth Ramell) female
## 68                             Crease, Mr. Ernest James    male
## 70                                  Kink, Mr. Vincenz    male
## 73                                Hood, Mr. Ambrose Jr    male
## 74                           Chronopoulos, Mr. Apostolos    male
## 76                             Moen, Mr. Sigurd Hansen    male
## 77                                  Staneff, Mr. Ivan    male
## 78                             Moutal, Mr. Rahamin Haim    male
## 80                            Dowdell, Miss. Elizabeth female
## 83                           McDermott, Miss. Brigdet Delia female
## 89                           Fortune, Miss. Mabel Helen female
## 91                                Christmann, Mr. Emil    male
## 93                             Chaffee, Mr. Herbert Fuller    male
## 97                             Goldschmidt, Mr. George B    male
## 98                          Greenfield, Mr. William Bertram    male
## 100                                  Kantor, Mr. Sinai    male
## 103                             White, Mr. Richard Frasar    male
## 105                         Gustafsson, Mr. Anders Vilhelm    male
## 106                               Mionoff, Mr. Stoytcho    male
## 107                         Salkjelsvik, Miss. Anna Kristine female
## 113                               Barton, Mr. David John    male
## 121                           Hickman, Mr. Stanley George    male
## 122                            Moore, Mr. Leonard Charles    male
## 134         Weisz, Mrs. Leopold (Mathilde Francoise Pede) female
## 145                             Andrew, Mr. Edgardo Samuel    male
## 150                      Byles, Rev. Thomas Roussel Davids    male
```

```
## 152                      Pears, Mrs. Thomas (Edith Wearne) female
## 155                            Olsen, Mr. Ole Martin   male
## 159                            Smiljanic, Mr. Mile   male
## 161                         Cribb, Mr. John Hatfield   male
## 163                        Bengtsson, Mr. John Viktor   male
## 166        Goldsmith, Master. Frank John William "Frankie"   male
## 168        Skoog, Mrs. William (Anna Bernhardina Karlsson) female
## 176                           Klasen, Mr. Klas Albin   male
## 177                        Lefebre, Master. Henry Forbes   male
## 178                        Isham, Miss. Ann Elizabeth female
## 179                             Hale, Mr. Reginald   male
## 180                            Leonard, Mr. Lionel   male
## 183               Asplund, Master. Clarence Gustaf Hugo   male
## 187        O'Brien, Mrs. Thomas (Johanna "Hannah" Godfrey) female
## 188          Romaine, Mr. Charles Hallace ("Mr C Rolmane")   male
## 193        Andersen-Jensen, Miss. Carla Christine Nielsine female
## 197                            Mernagh, Mr. Robert   male
## 199                      Madigan, Miss. Margaret "Maggie" female
## 204                           Youseff, Mr. Gerious   male
## 214                      Givard, Mr. Hans Kristensen   male
## 218                      Jacobsohn, Mr. Sidney Samuel   male
## 220                             Harris, Mr. Walter   male
## 227                         Mellors, Mr. William John   male
## 229                         Fahlstrom, Mr. Arne Jonas   male
## 231        Harris, Mrs. Henry Birkhardt (Irene Wallach) female
## 232                           Larsson, Mr. Bengt Edvin   male
## 234                      Asplund, Miss. Lillian Gertrud female
## 236                      Harknett, Miss. Alice Phoebe female
## 237                             Hold, Mr. Stephen   male
## 243                     Coleridge, Mr. Reginald Charles   male
## 244                       Maenpaa, Mr. Matti Alexanteri   male
## 249                       Beckwith, Mr. Richard Leonard   male
## 253                         Stead, Mr. William Thomas   male
## 255        Rosblom, Mrs. Viktor (Helena Wilhelmina) female
## 257                      Thorne, Mrs. Gertrude Maybelle female
## 259                              Ward, Miss. Anna female
## 263                             Taussig, Mr. Emil   male
## 266                             Reeves, Mr. David   male
## 269        Graham, Mrs. William Thompson (Edith Junkins) female
## 270                          Bissette, Miss. Amelia female
## 271                          Cairns, Mr. Alexander   male
## 272                      Tornquist, Mr. William Henry   male
## 275                        Healy, Miss. Hanora "Nora" female
## 284                       Dorking, Mr. Edward Arthur   male
## 286                            Stankovic, Mr. Ivan   male
## 287                          de Mulder, Mr. Theodore   male
## 288                            Naidenoff, Mr. Penko   male
## 289                           Hosono, Mr. Masabumi   male
## 292        Bishop, Mrs. Dickinson H (Helen Walton) female
## 296                             Lewy, Mr. Ervin G   male
## 297                            Hanna, Mr. Mansour   male
## 298                      Allison, Miss. Helen Loraine female
## 301        Kelly, Miss. Anna Katherine "Annie Kate" female
## 303                      Johnson, Mr. William Cahoone Jr   male
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## 309                                     Abelson, Mr. Samuel   male
## 312                         Ryerson, Miss. Emily Borie female
## 315                             Hart, Mr. Benjamin   male
## 316                 Nilsson, Miss. Helmina Josefina female
## 318                           Moraweck, Dr. Ernest   male
## 323                        Slayter, Miss. Hilda Mary female
## 330                    Hippach, Miss. Jean Gertrude female
## 331                              McCoy, Miss. Agnes female
## 336                             Denkoff, Mr. Mitto   male
## 337                       Pears, Mr. Thomas Clinton   male
## 339                         Dahl, Mr. Karl Edwart   male
## 340                     Blackwell, Mr. Stephen Weart   male
## 345                         Fox, Mr. Stanley Hubert   male
## 346                   Brown, Miss. Amelia "Mildred" female
## 349           Coutts, Master. William Loch "William"   male
## 350                             Dimic, Mr. Jovan   male
## 351                         Odahl, Mr. Nils Martin   male
## 352        Williams-Lambert, Mr. Fletcher Fellows   male
## 355                             Yousif, Mr. Wazli   male
## 356                   Vanden Steen, Mr. Leo Peter   male
## 365                             O'Brien, Mr. Thomas   male
## 369                           Jermyn, Miss. Annie female
## 370                 Aubart, Mme. Leontine Pauline female
## 372                     Wiklund, Mr. Jakob Alfred   male
## 381                           Bidois, Miss. Rosalie female
## 383                             Tikkanen, Mr. Juho   male
## 384         Holverson, Mrs. Alexander Oskar (Mary Aline Towner) female
## 385                         Plotcharsky, Mr. Vasil   male
## 386                     Davies, Mr. Charles Henry   male
## 390                     Lehmann, Miss. Bertha female
## 406                             Gale, Mr. Shadrach   male
## 412                             Hart, Mr. Henry   male
## 415                     Sundman, Mr. Johan Julian   male
## 425                     Rosblom, Mr. Viktor Richard   male
## 428 Phillips, Miss. Kate Florence ("Mrs Kate Louise Phillips Marshall") female
## 430                 Pickard, Mr. Berk (Berk Trembisky)   male
## 439                             Fortune, Mr. Mark   male
## 442                             Hampe, Mr. Leon   male
## 446                 Dodge, Master. Washington   male
## 454                     Goldenberg, Mr. Samuel L   male
## 461                         Anderson, Mr. Harry   male
## 465                             Maisner, Mr. Simon   male
## 467                     Campbell, Mr. William   male
## 477                     Renouf, Mr. Peter Henry   male
## 480                     Hirvonen, Miss. Hildur E female
## 485                     Bishop, Mr. Dickinson H   male
## 487         Hoyt, Mrs. Frederick Maxfield (Jane Anne Forby) female
## 489                     Somerton, Mr. Francis William   male
## 491             Hagland, Mr. Konrad Mathias Reiersen   male
## 492                         Windelov, Mr. Einar   male
## 498                 Shellard, Mr. Frederick William   male
## 506             Penasco y Castellana, Mr. Victor de Satode   male
## 508             Bradley, Mr. George ("George Arthur Brayton")   male
## 509                     Olsen, Mr. Henry Margido   male
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## 514                      Rothschild, Mrs. Martin (Elizabeth L. Barrett) female
## 519          Angle, Mrs. William A (Florence "Mary" Agnes Hughes) female
## 520                                        Pavlovic, Mr. Stefo    male
## 526                                          Farrell, Mr. James    male
## 529                                  Salonen, Mr. Johan Werner    male
## 531                                  Quick, Miss. Phyllis May female
## 533                                        Elias, Mr. Joseph Jr    male
## 535                                        Cacic, Miss. Marija female
## 537                      Butt, Major. Archibald Willingham     male
## 539                                  Risien, Mr. Samuel Beard     male
## 541                                  Crosby, Miss. Harriet R female
## 543                          Andersson, Miss. Sigrid Elisabeth female
## 546                              Nicholson, Mr. Arthur Ernest     male
## 548                              Padro y Manent, Mr. Julian     male
## 552                              Sharp, Mr. Percival James R     male
## 565                              Meanwell, Miss. (Marion Ogden) female
## 573                              Flynn, Mr. John Irwin ("Irving")    male
## 578                  Silvey, Mrs. William Baird (Alice Munger) female
## 579                      Caram, Mrs. Joseph (Maria Elias) female
## 589                                    Gilinski, Mr. Eliezer     male
## 591                                      Rintamaki, Mr. Matti     male
## 605                          Homer, Mr. Harry ("Mr E Haven")     male
## 611      Andersson, Mrs. Anders Johan (Alfrida Konstantia Brogren) female
## 612                                  Jardin, Mr. Jose Neto     male
## 614                                        Horgan, Mr. John     male
## 615                          Brocklebank, Mr. William Alfred     male
## 620                                    Gavey, Mr. Lawrence     male
## 622                          Kimball, Mr. Edwin Nelson Jr     male
## 632                          Lundahl, Mr. Johan Svensson     male
## 633                          Stahelin-Maeglin, Dr. Max     male
## 634                      Parr, Mr. William Henry Marsh     male
## 635                                      Skoog, Miss. Mabel female
## 644                                        Foo, Mr. Choong     male
## 651                                        Mitkoff, Mr. Mito     male
## 652                                      Doling, Miss. Elsie female
## 655                              Hegarty, Miss. Hanora "Nora" female
## 658                          Bourke, Mrs. John (Catherine) female
## 660                              Newell, Mr. Arthur Webster     male
## 663                              Colley, Mr. Edward Pomeroy     male
## 666                                      Hickman, Mr. Lewis     male
## 670          Taylor, Mrs. Elmer Zebley (Juliet Cummins Wright) female
## 671      Brown, Mrs. Thomas William Solomon (Elizabeth Catherine Ford) female
## 673                              Mitchell, Mr. Henry Michael     male
## 676                              Edvardsson, Mr. Gustaf Hjalmar     male
## 685                          Brown, Mr. Thomas William Solomon     male
## 686                  Laroche, Mr. Joseph Philippe Lemercier     male
## 688                                        Dakic, Mr. Branko     male
## 691                                  Dick, Mr. Albert Adrian     male
## 698                          Mullens, Miss. Katherine "Katie" female
## 701      Astor, Mrs. John Jacob (Madeleine Talmadge Force) female
## 702                          Silverthorne, Mr. Spencer Victor     male
## 703                                  Barbara, Miss. Saiide female
## 704                                  Gallagher, Mr. Martin     male
## 706          Morley, Mr. Henry Samuel ("Mr Henry Marshall")     male
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## 707                                        Kelly, Mrs. Florence "Fannie" female
## 708                              Calderhead, Mr. Edward Pennington   male
## 709                                          Cleaver, Miss. Alice female
## 710             Moubarek, Master. Halim Gonios ("William George")   male
## 713                                      Taylor, Mr. Elmer Zebley   male
## 718                         Troutt, Miss. Edwina Celia "Winnie" female
## 720                                 Johnson, Mr. Malkolm Joackim   male
## 722                                  Jensen, Mr. Svend Lauritz   male
## 724                                  Hodges, Mr. Henry Price   male
## 739                                         Ivanoff, Mr. Kanio   male
## 751                                         Wells, Miss. Joan female
## 753                            Vande Velde, Mr. Johannes Joseph   male
## 755                             Herman, Mrs. Samuel (Jane Laver) female
## 756                                  Hamalainen, Master. Viljo   male
## 764                   Carter, Mrs. William Ernest (Lucile Polk) female
## 765                                    Eklund, Mr. Hans Linus   male
## 766                    Hogeboom, Mrs. John C (Anna Andrews) female
## 768                                         Mangan, Miss. Mary female
## 769                                        Moran, Mr. Daniel J   male
## 771                                  Lievens, Mr. Rene Aime   male
## 772                                 Jensen, Mr. Niels Peder   male
## 775                   Hocking, Mrs. Elizabeth (Eliza Needs) female
## 777                                          Tobin, Mr. Roger   male
## 782                   Dick, Mrs. Albert Adrian (Vera Gillespie) female
## 785                                          Ali, Mr. William   male
## 786                     Harmer, Mr. Abraham (David Lishin)   male
## 788                             Rice, Master. George Hugh   male
## 789                            Dean, Master. Bertram Vere   male
## 790                             Guggenheim, Mr. Benjamin   male
## 794                             Hoyt, Mr. William Fisher   male
## 797                            Leader, Dr. Alice (Farnham) female
## 798                                       Osman, Mrs. Mara female
## 801                                    Ponesell, Mr. Martin   male
## 808                          Pettersson, Miss. Ellen Natalia female
## 815                            Tomlin, Mr. Ernest Portage   male
## 816                                          Fry, Mr. Richard   male
## 820                          Skoog, Master. Karl Thorsten   male
## 823                          Reuchlin, Jonkheer. John George   male
## 825                           Panula, Master. Urho Abraham   male
## 826                                          Flynn, Mr. John   male
## 831                   Yasbeck, Mrs. Antoni (Selini Alexander) female
## 838                                       Sirota, Mr. Maurice   male
## 840                                     Marechal, Mr. Pierre   male
## 847                             Sage, Mr. Douglas Bullen   male
## 848                                        Markoff, Mr. Marin   male
## 851                   Andersson, Master. Sigvard Harald Elias   male
## 854                              Lines, Miss. Mary Conover female
## 856                              Aks, Mrs. Sam (Leah Rosen) female
## 860                                         Razi, Mr. Raihed   male
## 861                              Hansen, Mr. Claus Peter   male
## 864                   Sage, Miss. Dorothy Edith "Dolly" female
## 866                              Bystrom, Mrs. (Karolina) female
## 867                          Duran y More, Miss. Asuncion female
## 870                          Johnson, Master. Harold Theodor   male
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## 876                                  Najib, Miss. Adele Kiamie "Jane" female
## 877                                 Gustafsson, Mr. Alfred Ossian   male
## 881          Shelley, Mrs. William (Imanita Parrish Hall) female
## 884                                  Banfield, Mr. Frederick James   male
##       age sib_sp parch        ticket     fare         cabin embarked
## 1   22.00      1     0     A/5 21171   7.2500          <NA>        S
## 5   35.00      0     0        373450   8.0500          <NA>        S
## 10  14.00      1     0        237736  30.0708          <NA>        C
## 12  58.00      0     0        113783  26.5500          C103        S
## 18     NA      0     0        244373  13.0000          <NA>        S
## 20     NA      0     0          2649   7.2250          <NA>        C
## 22  34.00      0     0        248698  13.0000          D56         S
## 23  15.00      0     0        330923   8.0292          <NA>        Q
## 25   8.00      3     1        349909  21.0750          <NA>        S
## 27     NA      0     0          2631   7.2250          <NA>        C
## 30     NA      0     0        349216   7.8958          <NA>        S
## 41  40.00      1     0          7546   9.4750          <NA>        S
## 46     NA      0     0 S.C./A.4. 23567   8.0500        <NA>        S
## 49     NA      2     0          2662  21.6792          <NA>        C
## 50  18.00      1     0        349237  17.8000          <NA>        S
## 51   7.00      4     1       3101295  39.6875          <NA>        S
## 52  21.00      0     0     A/4. 39886   7.8000          <NA>        S
## 54  29.00      1     0          2926  26.0000          <NA>        S
## 55  65.00      0     1        113509  61.9792          B30         C
## 56     NA      0     0         19947  35.5000          C52         S
## 57  21.00      0     0    C.A. 31026  10.5000          <NA>        S
## 65     NA      0     0      PC 17605  27.7208          <NA>        C
## 67  29.00      0     0    C.A. 29395  10.5000          F33         S
## 68  19.00      0     0     S.P. 3464   8.1583          <NA>        S
## 70  26.00      2     0        315151   8.6625          <NA>        S
## 73  21.00      0     0   S.O.C. 14879  73.5000          <NA>        S
## 74  26.00      1     0          2680  14.4542          <NA>        C
## 76  25.00      0     0        348123   7.6500          F G73       S
## 77     NA      0     0        349208   7.8958          <NA>        S
## 78     NA      0     0        374746   8.0500          <NA>        S
## 80  30.00      0     0        364516  12.4750          <NA>        S
## 83     NA      0     0        330932   7.7875          <NA>        Q
## 89  23.00      3     2         19950 263.0000   C23 C25 C27        S
## 91  29.00      0     0        343276   8.0500          <NA>        S
## 93  46.00      1     0   W.E.P. 5734  61.1750          E31         S
## 97  71.00      0     0      PC 17754  34.6542          A5          C
## 98  23.00      0     1      PC 17759  63.3583          D10 D12     C
## 100 34.00      1     0        244367  26.0000          <NA>        S
## 103 21.00      0     1         35281  77.2875          D26         S
## 105 37.00      2     0       3101276   7.9250          <NA>        S
## 106 28.00      0     0        349207   7.8958          <NA>        S
## 107 21.00      0     0        343120   7.6500          <NA>        S
## 113 22.00      0     0        324669   8.0500          <NA>        S
## 121 21.00      2     0   S.O.C. 14879  73.5000          <NA>        S
## 122    NA      0     0     A4. 54510   8.0500          <NA>        S
## 134 29.00      1     0        228414  26.0000          <NA>        S
## 145 18.00      0     0        231945  11.5000          <NA>        S
## 150 42.00      0     0        244310  13.0000          <NA>        S
## 152 22.00      1     0        113776  66.6000          C2          S
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## 155    NA   0   0          Fa 265302    7.3125         <NA>      S
## 159    NA   0   0             315037    8.6625         <NA>      S
## 161 44.00   0   1             371362   16.1000         <NA>      S
## 163 26.00   0   0             347068    7.7750         <NA>      S
## 166  9.00   0   2             363291   20.5250         <NA>      S
## 168 45.00   1   4             347088   27.9000         <NA>      S
## 176 18.00   1   1             350404    7.8542         <NA>      S
## 177    NA   3   1               4133   25.4667         <NA>      S
## 178 50.00   0   0          PC 17595   28.7125          C49       C
## 179 30.00   0   0             250653   13.0000         <NA>      S
## 180 36.00   0   0               LINE    0.0000         <NA>      S
## 183  9.00   4   2             347077   31.3875         <NA>      S
## 187    NA   1   0             370365   15.5000         <NA>      Q
## 188 45.00   0   0             111428   26.5500         <NA>      S
## 193 19.00   1   0             350046    7.8542         <NA>      S
## 197    NA   0   0             368703    7.7500         <NA>      Q
## 199    NA   0   0             370370    7.7500         <NA>      Q
## 204 45.50   0   0               2628    7.2250         <NA>      C
## 214 30.00   0   0             250646   13.0000         <NA>      S
## 218 42.00   1   0             243847   27.0000         <NA>      S
## 220 30.00   0   0          W/C 14208   10.5000         <NA>      S
## 227 19.00   0   0          SW/PP 751   10.5000         <NA>      S
## 229 18.00   0   0             236171   13.0000         <NA>      S
## 231 35.00   1   0              36973   83.4750          C83       S
## 232 29.00   0   0             347067    7.7750         <NA>      S
## 234  5.00   4   2             347077   31.3875         <NA>      S
## 236    NA   0   0         W./C. 6609    7.5500         <NA>      S
## 237 44.00   1   0              26707   26.0000         <NA>      S
## 243 29.00   0   0         W./C. 14263  10.5000         <NA>      S
## 244 22.00   0   0  STON/O 2. 3101275    7.1250         <NA>      S
## 249 37.00   1   1              11751   52.5542          D35       S
## 253 62.00   0   0             113514   26.5500          C87       S
## 255 41.00   0   2             370129   20.2125         <NA>      S
## 257    NA   0   0          PC 17585   79.2000          <NA>      C
## 259 35.00   0   0          PC 17755  512.3292          <NA>      C
## 263 52.00   1   1             110413   79.6500          E67       S
## 266 36.00   0   0         C.A. 17248  10.5000          <NA>      S
## 269 58.00   0   1          PC 17582  153.4625         C125       S
## 270 35.00   0   0          PC 17760  135.6333          C99       S
## 271    NA   0   0             113798   31.0000         <NA>      S
## 272 25.00   0   0               LINE    0.0000         <NA>      S
## 275    NA   0   0             370375    7.7500         <NA>      Q
## 284 19.00   0   0         A/5. 10482    8.0500         <NA>      S
## 286 33.00   0   0             349239    8.6625         <NA>      C
## 287 30.00   0   0             345774    9.5000         <NA>      S
## 288 22.00   0   0             349206    7.8958         <NA>      S
## 289 42.00   0   0             237798   13.0000         <NA>      S
## 292 19.00   1   0              11967   91.0792          B49       C
## 296    NA   0   0          PC 17612   27.7208          <NA>      C
## 297 23.50   0   0               2693    7.2292         <NA>      C
## 298  2.00   1   2             113781  151.5500       C22 C26     S
## 301    NA   0   0               9234    7.7500         <NA>      Q
## 303 19.00   0   0               LINE    0.0000         <NA>      S
## 309 30.00   1   0          P/PP 3381   24.0000         <NA>      C
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## 312 18.00      2   2       PC 17608 262.3750 B57 B59 B63 B66       C
## 315 43.00      1   1    F.C.C. 13529  26.2500         <NA>         S
## 316 26.00      0   0         347470   7.8542         <NA>         S
## 318 54.00      0   0          29011  14.0000         <NA>         S
## 323 30.00      0   0         234818  12.3500         <NA>         Q
## 330 16.00      0   1         111361  57.9792          B18         C
## 331    NA      2   0         367226  23.2500         <NA>         Q
## 336    NA      0   0         349225   7.8958         <NA>         S
## 337 29.00      1   0         113776  66.6000           C2         S
## 339 45.00      0   0           7598   8.0500         <NA>         S
## 340 45.00      0   0         113784  35.5000            T         S
## 345 36.00      0   0         229236  13.0000         <NA>         S
## 346 24.00      0   0         248733  13.0000          F33         S
## 349  3.00      1   1    C.A. 37671   15.9000         <NA>         S
## 350 42.00      0   0         315088   8.6625         <NA>         S
## 351 23.00      0   0           7267   9.2250         <NA>         S
## 352    NA      0   0         113510  35.0000         C128         S
## 355    NA      0   0           2647   7.2250         <NA>         C
## 356 28.00      0   0         345783   9.5000         <NA>         S
## 365    NA      1   0         370365  15.5000         <NA>         Q
## 369    NA      0   0          14313   7.7500         <NA>         Q
## 370 24.00      0   0       PC 17477  69.3000          B35         C
## 372 18.00      1   0        3101267   6.4958         <NA>         S
## 381 42.00      0   0       PC 17757 227.5250         <NA>         C
## 383 32.00      0   0 STON/O 2. 3101293   7.9250      <NA>         S
## 384 35.00      1   0         113789  52.0000         <NA>         S
## 385    NA      0   0         349227   7.8958         <NA>         S
## 386 18.00      0   0    S.O.C. 14879  73.5000         <NA>         S
## 390 17.00      0   0        SC 1748  12.0000         <NA>         C
## 406 34.00      1   0          28664  21.0000         <NA>         S
## 412    NA      0   0         394140   6.8583         <NA>         Q
## 415 44.00      0   0 STON/O 2. 3101269   7.9250      <NA>         S
## 425 18.00      1   1         370129  20.2125         <NA>         S
## 428 19.00      0   0         250655  26.0000         <NA>         S
## 430 32.00      0   0 SOTON/O.Q. 392078   8.0500       E10         S
## 439 64.00      1   4          19950 263.0000  C23 C25 C27         S
## 442 20.00      0   0         345769   9.5000         <NA>         S
## 446  4.00      0   2          33638  81.8583          A34         S
## 454 49.00      1   0          17453  89.1042          C92         C
## 461 48.00      0   0          19952  26.5500          E12         S
## 465    NA      0   0        A/S 2816   8.0500         <NA>         S
## 467    NA      0   0         239853   0.0000         <NA>         S
## 477 34.00      1   0          31027  21.0000         <NA>         S
## 480  2.00      0   1        3101298  12.2875         <NA>         S
## 485 25.00      1   0          11967  91.0792          B49         C
## 487 35.00      1   0          19943  90.0000          C93         S
## 489 30.00      0   0       A.5. 18509   8.0500        <NA>         S
## 491    NA      1   0          65304  19.9667         <NA>         S
## 492 21.00      0   0 SOTON/OQ 3101317   7.2500       <NA>         S
## 498    NA      0   0       C.A. 6212  15.1000         <NA>         S
## 506 18.00      1   0       PC 17758 108.9000          C65         C
## 508    NA      0   0         111427  26.5500         <NA>         S
## 509 28.00      0   0         C 4001  22.5250         <NA>         S
## 514 54.00      1   0       PC 17603  59.4000         <NA>         C
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## 519 36.00      1    0               226875   26.0000            <NA>      S
## 520 32.00      0    0               349242    7.8958            <NA>      S
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## 529 39.00      0    0              3101296    7.9250            <NA>      S
## 531  2.00      1    1                26360   26.0000            <NA>      S
## 533 17.00      1    1                 2690    7.2292            <NA>      C
## 535 30.00      0    0               315084    8.6625            <NA>      S
## 537 45.00      0    0               113050   26.5500             B38      S
## 539    NA      0    0               364498   14.5000            <NA>      S
## 541 36.00      0    2           WE/P 5735   71.0000             B22      S
## 543 11.00      4    2               347082   31.2750            <NA>      S
## 546 64.00      0    0                  693   26.0000            <NA>      S
## 548    NA      0    0      SC/PARIS 2146   13.8625            <NA>      C
## 552 27.00      0    0               244358   26.0000            <NA>      S
## 565    NA      0    0  SOTON/O.Q. 392087    8.0500            <NA>      S
## 573 36.00      0    0            PC 17474   26.3875             E25      S
## 578 39.00      1    0                13507   55.9000             E44      S
## 579    NA      1    0                 2689   14.4583            <NA>      C
## 589 22.00      0    0                14973    8.0500            <NA>      S
## 591 35.00      0    0     STON/O 2. 3101273    7.1250            <NA>      S
## 605 35.00      0    0               111426   26.5500            <NA>      C
## 611 39.00      1    5               347082   31.2750            <NA>      S
## 612    NA      0    0  SOTON/O.Q. 3101305    7.0500            <NA>      S
## 614    NA      0    0               370377    7.7500            <NA>      Q
## 615 35.00      0    0               364512    8.0500            <NA>      S
## 620 26.00      0    0                31028   10.5000            <NA>      S
## 622 42.00      1    0                11753   52.5542             D19      S
## 632 51.00      0    0               347743    7.0542            <NA>      S
## 633 32.00      0    0                13214   30.5000             B50      C
## 634    NA      0    0               112052    0.0000            <NA>      S
## 635  9.00      3    2               347088   27.9000            <NA>      S
## 644    NA      0    0                 1601   56.4958            <NA>      S
## 651    NA      0    0               349221    7.8958            <NA>      S
## 652 18.00      0    1               231919   23.0000            <NA>      S
## 655 18.00      0    0               365226    6.7500            <NA>      Q
## 658 32.00      1    1               364849   15.5000            <NA>      Q
## 660 58.00      0    2                35273  113.2750             D48      C
## 663 47.00      0    0                 5727   25.5875             E58      S
## 666 32.00      2    0         S.O.C. 14879   73.5000            <NA>      S
## 670    NA      1    0                19996   52.0000            C126      S
## 671 40.00      1    1                29750   39.0000            <NA>      S
## 673 70.00      0    0         C.A. 24580   10.5000            <NA>      S
## 676 18.00      0    0               349912    7.7750            <NA>      S
## 685 60.00      1    1                29750   39.0000            <NA>      S
## 686 25.00      1    2       SC/Paris 2123   41.5792            <NA>      C
## 688 19.00      0    0               349228   10.1708            <NA>      S
## 691 31.00      1    0                17474   57.0000             B20      S
## 698    NA      0    0                35852    7.7333            <NA>      Q
## 701 18.00      1    0            PC 17757  227.5250         C62 C64      C
## 702 35.00      0    0            PC 17475   26.2875             E24      S
## 703 18.00      0    1                 2691   14.4542            <NA>      C
## 704 25.00      0    0                36864    7.7417            <NA>      Q
## 706 39.00      0    0               250655   26.0000            <NA>      S
## 707 45.00      0    0               223596   13.5000            <NA>      S
```

```
## 708 42.00       0   0          PC 17476  26.2875           E24       S
## 709 22.00       0   0            113781 151.5500          <NA>       S
## 710    NA       1   1              2661  15.2458          <NA>       C
## 713 48.00       1   0             19996  52.0000          C126       S
## 718 27.00       0   0             34218  10.5000          E101       S
## 720 33.00       0   0            347062   7.7750          <NA>       S
## 722 17.00       1   0            350048   7.0542          <NA>       S
## 724 50.00       0   0            250643  13.0000          <NA>       S
## 739    NA       0   0            349201   7.8958          <NA>       S
## 751  4.00       1   1             29103  23.0000          <NA>       S
## 753 33.00       0   0            345780   9.5000          <NA>       S
## 755 48.00       1   2            220845  65.0000          <NA>       S
## 756  0.67       1   1            250649  14.5000          <NA>       S
## 764 36.00       1   2            113760 120.0000       B96 B98       S
## 765 16.00       0   0            347074   7.7750          <NA>       S
## 766 51.00       1   0             13502  77.9583           D11       S
## 768 30.50       0   0            364850   7.7500          <NA>       Q
## 769    NA       1   0            371110  24.1500          <NA>       Q
## 771 24.00       0   0            345781   9.5000          <NA>       S
## 772 48.00       0   0            350047   7.8542          <NA>       S
## 775 54.00       1   3             29105  23.0000          <NA>       S
## 777    NA       0   0            383121   7.7500           F38       Q
## 782 17.00       1   0             17474  57.0000           B20       S
## 785 25.00       0   0 SOTON/O.Q. 3101312   7.0500          <NA>       S
## 786 25.00       0   0            374887   7.2500          <NA>       S
## 788  8.00       4   1            382652  29.1250          <NA>       Q
## 789  1.00       1   2          C.A. 2315  20.5750          <NA>       S
## 790 46.00       0   0          PC 17593  79.2000       B82 B84       C
## 794    NA       0   0          PC 17600  30.6958          <NA>       C
## 797 49.00       0   0             17465  25.9292           D17       S
## 798 31.00       0   0            349244   8.6833          <NA>       S
## 801 34.00       0   0            250647  13.0000          <NA>       S
## 808 18.00       0   0            347087   7.7750          <NA>       S
## 815 30.50       0   0            364499   8.0500          <NA>       S
## 816    NA       0   0            112058   0.0000          B102       S
## 820 10.00       3   2            347088  27.9000          <NA>       S
## 823 38.00       0   0             19972   0.0000          <NA>       S
## 825  2.00       4   1           3101295  39.6875          <NA>       S
## 826    NA       0   0            368323   6.9500          <NA>       Q
## 831 15.00       1   0              2659  14.4542          <NA>       C
## 838    NA       0   0            392092   8.0500          <NA>       S
## 840    NA       0   0             11774  29.7000           C47       C
## 847    NA       8   2          CA. 2343  69.5500          <NA>       S
## 848 35.00       0   0            349213   7.8958          <NA>       C
## 851  4.00       4   2            347082  31.2750          <NA>       S
## 854 16.00       0   1          PC 17592  39.4000           D28       S
## 856 18.00       0   1            392091   9.3500          <NA>       S
## 860    NA       0   0              2629   7.2292          <NA>       C
## 861 41.00       2   0            350026  14.1083          <NA>       S
## 864    NA       8   2          CA. 2343  69.5500          <NA>       S
## 866 42.00       0   0            236852  13.0000          <NA>       S
## 867 27.00       1   0      SC/PARIS 2149  13.8583          <NA>       C
## 870  4.00       1   1            347742  11.1333          <NA>       S
## 876 15.00       0   0              2667   7.2250          <NA>       C
```

```
## 877 20.00      0    0               7534   9.8458          <NA>       S
## 881 25.00      0    1             230433  26.0000          <NA>       S
## 884 28.00      0    0   C.A./SOTON 34068  10.5000          <NA>       S
```

Question 2

Using the **training** data set, explore/describe the distribution of the outcome variable `survived`.

```
titanic_train %>%
  ggplot(aes( x = survived )) +
  geom_bar()
```
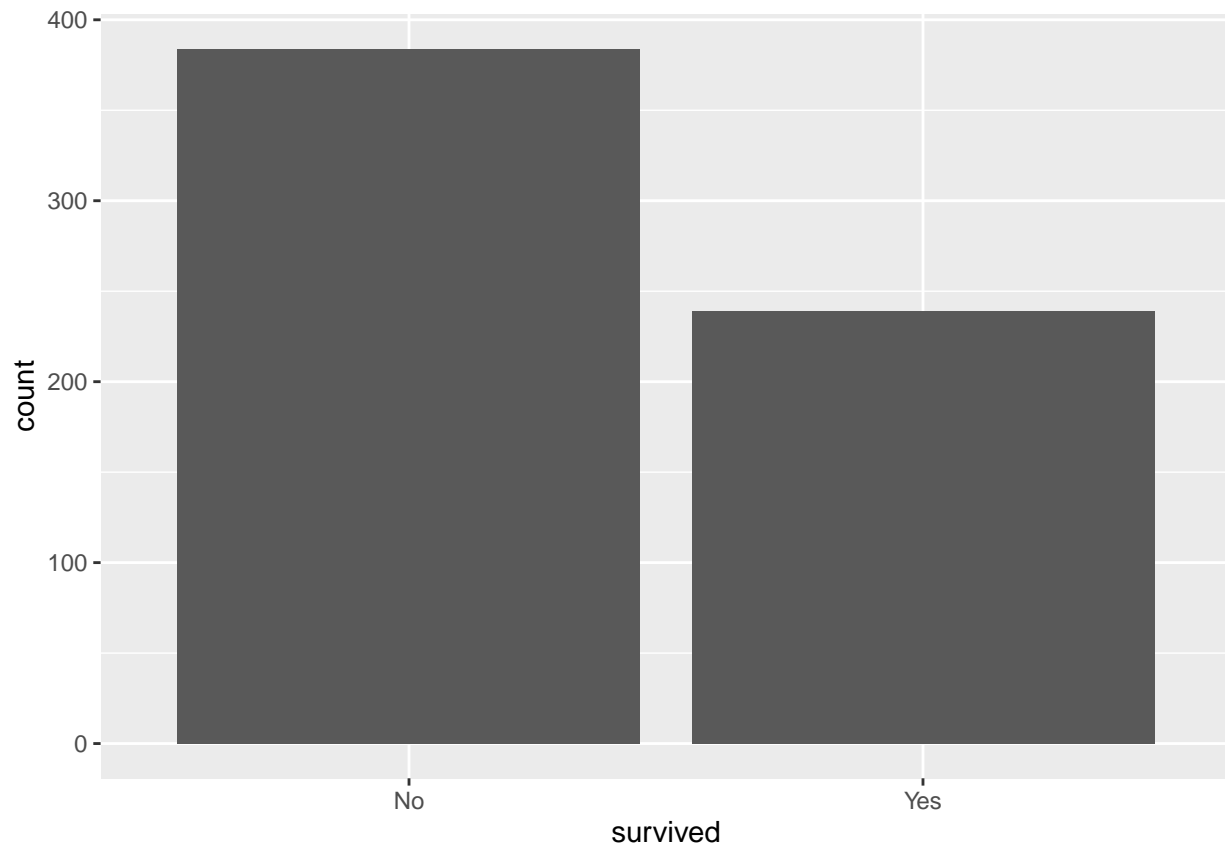

The outcome variable "survived" has two categories, "Yes" and "No". Here, there are more "No" variables than the "Yes" variables. The total number of variables seems to be approximately over 600.

Question 3

Using the **training** data set, create a correlation matrix of all continuous variables. Create a visualization of the matrix, and describe any patterns you see. Are any predictors correlated with each other? Which ones, and in which direction?

Yes there are predictors correlated with each other. The age and parch predictors are negatively correlated to each other, and the parch and fare predictors are positively correlated to each other.

```
cor_titanic <- titanic_train %>%
  select(-survived, -pclass, -name, -sex, -sib_sp, -ticket, -cabin, -embarked) %>%
  cor(use = "pairwise.complete.obs", method = "pearson")
rplot(cor_titanic)
```
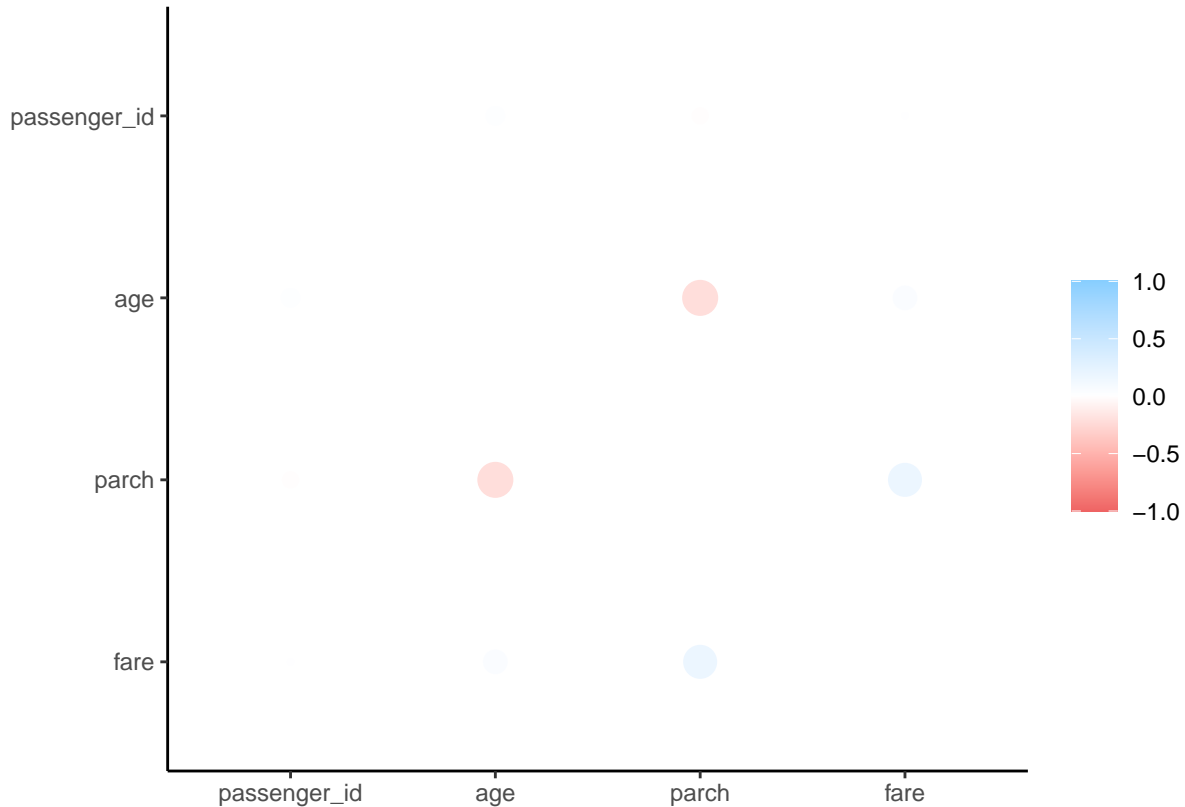

Question 4

Using the **training** data, create a recipe predicting the outcome variable `survived`. Include the following predictors: ticket class, sex, age, number of siblings or spouses aboard, number of parents or children aboard, and passenger fare.

Recall that there were missing values for `age`. To deal with this, add an imputation step using `step_impute_linear()`. Next, use `step_dummy()` to **dummy** encode categorical predictors. Finally, include interactions between:

- Sex and passenger fare, and
- Age and passenger fare.

You'll need to investigate the `tidymodels` documentation to find the appropriate step functions to use.

```
library(modeldata)
titanic_recipe <- recipe(survived ~ pclass+ sex + age + sib_sp + parch + fare, data = titanic_train) %>%
  step_impute_linear(age) %>%
  step_dummy(all_nominal_predictors()) %>%
```

```
  prep()

int_mod_2 <- titanic_recipe %>%
  step_dummy(sex, age) %>%
  step_interact(terms = ~ fare)
tidy(int_mod_2, number = 1)
```

```
## # A tibble: 1 x 3
##   terms model  id
##   <chr> <list> <chr>
## 1 age   <lm>   impute_linear_KFFEN
```

Question 5

Specify a **logistic regression** model for classification using the `"glm"` engine. Then create a workflow. Add your model and the appropriate recipe. Finally, use `fit()` to apply your workflow to the **training** data.

Hint: Make sure to store the results of `fit()`. You'll need them later on.

```
log_reg <- logistic_reg() %>%
  set_engine("glm") %>%
  set_mode("classification")

log_wkflow <- workflow() %>%
  add_model(log_reg) %>%
  add_recipe(titanic_recipe)

log_fit <- fit(log_wkflow, titanic_train)

log_fit %>%
  tidy()
```

```
## # A tibble: 6 x 5
##   term        estimate std.error statistic  p.value
##   <chr>          <dbl>     <dbl>     <dbl>    <dbl>
## 1 (Intercept)   2.72      0.559      4.86 1.16e- 6
## 2 pclass       -0.958     0.155     -6.19 6.00e-10
## 3 age          -0.0383    0.00824   -4.65 3.24e- 6
## 4 sib_sp       -0.281     0.0985    -2.85 4.39e- 3
## 5 parch         0.261     0.116      2.25 2.46e- 2
## 6 fare          0.00461   0.00299    1.54 1.23e- 1
```

Question 6

Repeat Question 5, but this time specify a linear discriminant analysis model for classification using the `"MASS"` engine.

```
lda_mod <-discrim_linear() %>%
  set_mode("classification") %>%
  set_engine("MASS")
```

```
lda_wkflow <- workflow() %>%
  add_model(lda_mod) %>%
  add_recipe(titanic_recipe)

lda_fit <- fit(lda_wkflow, titanic_train)
```

Question 7

Repeat Question 5, but this time specify a quadratic discriminant analysis model for classification using the `"MASS"` engine.

```
qda_mod <- discrim_quad() %>%
  set_mode("classification") %>%
  set_engine("MASS")

qda_wkflow <- workflow() %>%
  add_model(qda_mod) %>%
  add_recipe(titanic_recipe)

qda_fit <- fit(qda_wkflow, titanic_train)
```

Question 8

Repeat Question 5, but this time specify a naive Bayes model for classification using the `"klaR"` engine. Set the `usekernel` argument to `FALSE`.

```
nb_mod <- naive_Bayes() %>%
  set_mode("classification") %>%
  set_engine("klaR") %>%
  set_args(usekernel = FALSE)

nb_wkflow <- workflow() %>%
  add_model(nb_mod) %>%
  add_recipe(titanic_recipe)

nb_fit <- fit(nb_wkflow, titanic_train)
```

Question 9

Now you've fit four different models to your training data.

Use `predict()` and `bind_cols()` to generate predictions using each of these 4 models and your **training** data. Then use the *accuracy* metric to assess the performance of each of the four models.

Which model achieved the highest accuracy on the training data?

The logistic regression model achieved the highest accuracy on the training data since our accuracy estimate is 0.6837881 and the logistic regression model is closest to this, which is 0.6837881.

```
pred_log = predict(log_fit, new_data = titanic_train, type = "class")
pred_lda = predict(lda_fit, new_data = titanic_train, type = "class")
pred_qda = predict(qda_fit, new_data = titanic_train, type = "class")
```

```
pred_nb = predict(nb_fit, new_data = titanic_train, type = "class")

bind <- bind_cols(log = pred_log$.pred_class, lda = pred_lda$.pred_class, qda = pred_qda$.pred_class, nb

bind
```

```
## # A tibble: 623 x 5
##    log   lda   qda   nb    survived
##    <fct> <fct> <fct> <fct> <chr>
##  1 No    No    No    No    No
##  2 No    No    No    Yes   No
##  3 No    No    No    No    No
##  4 No    No    No    No    No
##  5 No    No    No    No    No
##  6 No    No    No    No    No
##  7 No    No    No    No    No
##  8 No    No    No    No    No
##  9 No    No    No    No    No
## 10 Yes   Yes   Yes   Yes   No
## # ... with 613 more rows
```

```
log_reg_acc <- bind %>%
  accuracy(truth = factor(survived), estimate = log)
log_reg_acc
```

```
## # A tibble: 1 x 3
##   .metric  .estimator .estimate
##   <chr>    <chr>          <dbl>
## 1 accuracy binary         0.700
```

```
lda_acc <- bind %>%
  accuracy(truth = factor(survived), estimate = lda)

nb_acc <- bind %>%
  accuracy(truth = factor(survived), estimate = nb)

qda_acc <- bind %>%
  accuracy(truth = factor(survived), estimate = qda)

accuracies <- c(log_reg_acc$.estimate, lda_acc$.estimate,
                nb_acc$.estimate, qda_acc$.estimate)

log_reg_acc$.estimate
```

```
## [1] 0.6998395
```

```
models <- c("Logistic Regression", "LDA", "Naive Bayes", "QDA")
results <- tibble(accuracies = accuracies, models = models)
results %>%
  arrange(-accuracies)
```

```
## # A tibble: 4 x 2
##   accuracies models
##        <dbl> <chr>
## 1      0.727 QDA
## 2      0.705 LDA
## 3      0.700 Logistic Regression
## 4      0.681 Naive Bayes
```

```
augment(log_fit, new_data = titanic_train) %>%
  conf_mat(truth = survived, estimate = .pred_class)
```

```
##           Truth
## Prediction  No Yes
##        No  333 136
##        Yes  51 103
```

Question 10

Fit the model with the highest training accuracy to the **testing** data. Report the accuracy of the model on the **testing** data.

Again using the **testing** data, create a confusion matrix and visualize it. Plot an ROC curve and calculate the area under it (AUC).

How did the model perform? Compare its training and testing accuracies. If the values differ, why do you think this is so?

Note that a good preforming model would ideally have higher numbers along the diagonal (up-left to down-right) with small numbers on the off-diagonal. In other words, the model would not be great if it tends to predict "No" as "Yes" more often than it should. Additionally, the test accuracy should not be higher than the train accuracy since the model is optimized for the latter. In my case, the accuracy for the training data set is higher than the testing data set. This is because for my training dataset, there are more predicts where "No" was considered a "Yes". Therefore, the training dataset's accuracy is slightly better because of this.

```
pred_log = predict(log_fit, new_data = titanic_test, type = "class")
pred_lda = predict(lda_fit, new_data = titanic_test, type = "class")
pred_qda = predict(qda_fit, new_data = titanic_test, type = "class")
pred_nb = predict(nb_fit, new_data = titanic_test, type = "class")
```

```
bind <- bind_cols(log = pred_log$.pred_class, lda = pred_lda$.pred_class, qda = pred_qda$.pred_class, n

bind
```

```
## # A tibble: 268 x 5
##    log   lda   qda   nb    survived
##    <fct> <fct> <fct> <fct> <chr>
## 1 No    No    No    No    No
## 2 No    No    No    No    No
## 3 Yes   Yes   No    No    Yes
## 4 No    No    No    Yes   Yes
## 5 No    No    No    No    Yes
## 6 No    No    No    No    Yes
```

```
##  7 No     No     No     No     Yes
##  8 No     No     No     No     Yes
##  9 No     No     No     No     No
## 10 No     No     No     No     No
## # ... with 258 more rows
```

```r
log_reg_acc <- bind %>%
  accuracy(truth = factor(survived), estimate = log)
log_reg_acc
```

```
## # A tibble: 1 x 3
##   .metric  .estimator .estimate
##   <chr>    <chr>          <dbl>
## 1 accuracy binary         0.724
```

```r
lda_acc <- bind %>%
  accuracy(truth = factor(survived), estimate = lda)

nb_acc <- bind %>%
  accuracy(truth = factor(survived), estimate = nb)

qda_acc <- bind %>%
  accuracy(truth = factor(survived), estimate = qda)

accuracies <- c(log_reg_acc$.estimate, lda_acc$.estimate,
                nb_acc$.estimate, qda_acc$.estimate)

log_reg_acc$.estimate
```

```
## [1] 0.7238806
```

```r
models <- c("Logistic Regression", "LDA", "Naive Bayes", "QDA")
results <- tibble(accuracies = accuracies, models = models)
results %>%
  arrange(-accuracies)
```

```
## # A tibble: 4 x 2
##   accuracies models
##        <dbl> <chr>
## 1      0.724 Logistic Regression
## 2      0.724 QDA
## 3      0.713 LDA
## 4      0.683 Naive Bayes
```

```r
augment(log_fit, new_data = titanic_test) %>%
  conf_mat(truth = survived, estimate = .pred_class)
```

```
##           Truth
## Prediction  No Yes
##        No  141  50
##        Yes  24  53
```

```
augment(nb_fit, new_data = titanic_test) %>%
  conf_mat(truth = survived, estimate = .pred_class)
```

```
##           Truth
## Prediction  No Yes
##        No  138  58
##        Yes  27  45
```

```
augment(lda_fit, new_data = titanic_test) %>%
  conf_mat(truth = survived, estimate = .pred_class)
```

```
##           Truth
## Prediction  No Yes
##        No  139  51
##        Yes  26  52
```

```
augment(qda_fit, new_data = titanic_test) %>%
  conf_mat(truth = survived, estimate = .pred_class)
```

```
##           Truth
## Prediction  No Yes
##        No  141  50
##        Yes  24  53
```

```
augment(log_fit, new_data = titanic_test) %>%
  conf_mat(truth = survived, estimate = .pred_class) %>%
  autoplot(type = "heatmap")
```

```
augment(log_fit, new_data = titanic_test) %>%
  roc_curve(factor(survived), .pred_No) %>%
  autoplot()
```
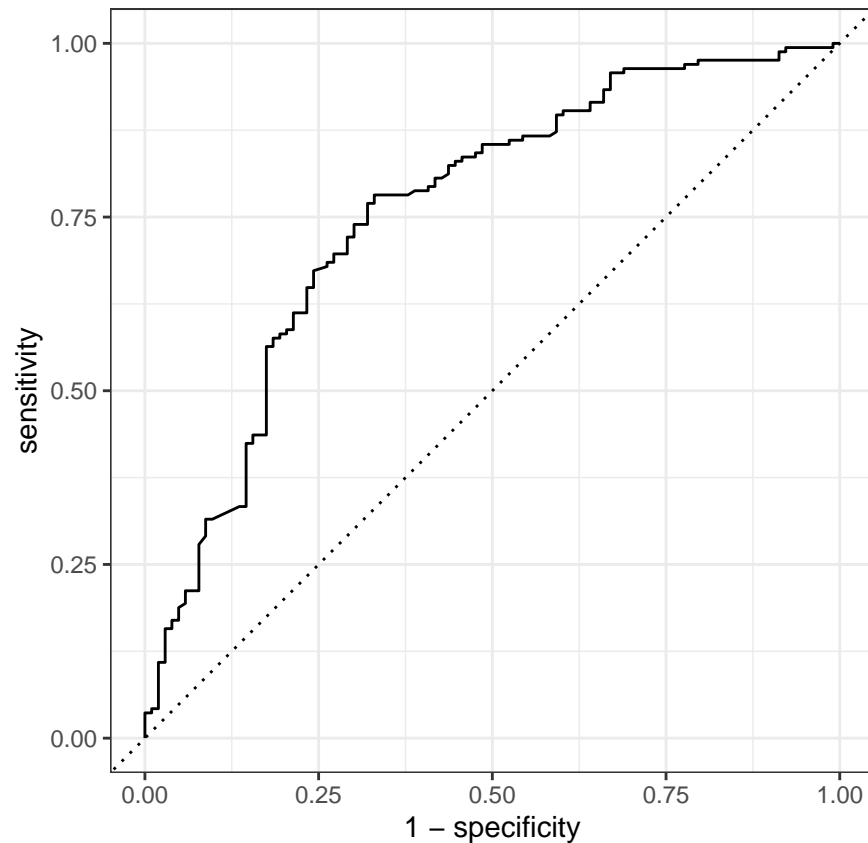
```
library(ggplot2)

augment(log_fit, new_data = titanic_test) %>%
  roc_auc(factor(survived), .pred_No)
```

```
## # A tibble: 1 x 3
##    .metric .estimator .estimate
##    <chr>   <chr>          <dbl>
## 1 roc_auc binary         0.757
```

Required for 231 Students

In a binary classification problem, let p represent the probability of class label 1, which implies that $1 - p$ represents the probability of class label 0. The *logistic function* (also called the "inverse logit") is the cumulative distribution function of the logistic distribution, which maps a real number z to the open interval $(0, 1)$.

Question 11

Given that:

$$p(z) = \frac{e^z}{1 + e^z}$$

Prove that the inverse of a logistic function is indeed the *logit* function:

$$z(p) = ln\left(\frac{p}{1-p}\right)$$

Question 12

Assume that $z = \beta_0 + \beta_1 x_1$ and $p = logistic(z)$. How do the odds of the outcome change if you increase x_1 by two? Demonstrate this.

Assume now that β_1 is negative. What value does p approach as x_1 approaches ∞? What value does p approach as x_1 approaches $-\infty$?