W5 In-class practice

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Instructions

Download a copy of this markdown. Change the `author:` tag above to have your name and NAU's ID. Fill in the chunks with your R code that solves the problem. Knit your final document into a HTML file and submit it through BBLearn in the assignment **[In-class] JSON** before the end of the day (**Thursday, Sep 29, 11:59 PM**).

If you're using any libraries to run your code, please load them here.

Problem 1

Download the `.json` file attached to this assignment. Write an R code that imports the file into a proper file handler. Use the parameter `simplifyVector = TRUE` (this will coerce the arrays with primitive types into atomic vectors. The variable used to store the json must be named `earthquake`. Use the `print()` function to explore the content of the file. Then, print the names of the keys in the first level of the `earthquake`.

```
# write your code here
earthquake <- fromJSON("earthquake.json", simplifyVector = T)
print(earthquake)
```

```
## $type
## [1] "FeatureCollection"
##
## $metadata
## $metadata$generated
## [1] 1.664401e+12
##
## $metadata$url
## [1] "https://earthquake.usgs.gov/fdsnws/event/1/query?format=geojson&starttime=2022-01-01&endtime=20
##
## $metadata$title
## [1] "USGS Earthquakes"
##
## $metadata$status
## [1] 200
##
## $metadata$api
## [1] "1.13.6"
##
## $metadata$count
```

```
## [1] 28
##
##
## $features
##       type properties.mag                          properties.place
## 1  Feature            6.1      65 km NNW of Bukittinggi, Indonesia
## 2  Feature            6.0         58 km W of Abra Pampa, Argentina
## 3  Feature            6.3                  Balleny Islands region
## 4  Feature            6.8                south of the Fiji Islands
## 5  Feature            6.2 12 km WSW of Nueva Concepción, Guatemala
## 6  Feature            6.0       168 km SSW of Merizo Village, Guam
## 7  Feature            6.2              central Mid-Atlantic Ridge
## 8  Feature            6.3                  southeast Indian Ridge
## 9  Feature            6.5               49 km NW of Barranca, Peru
## 10 Feature            6.0       184 km NE of Lospalos, Timor Leste
## 11 Feature            6.5                  Kermadec Islands region
## 12 Feature            6.0              281 km SW of Arenas, Panama
## 13 Feature            6.2              220 km WNW of Pangai, Tonga
## 14 Feature            6.0            South Sandwich Islands region
## 15 Feature            6.2              71 km S of Unalaska, Alaska
## 16 Feature            6.0      232 km SE of Sarangani, Philippines
## 17 Feature            6.3                27 km SSE of Saiki, Japan
## 18 Feature            6.1   74 km WSW of Panguna, Papua New Guinea
## 19 Feature            6.6            80 km SW of Labuan, Indonesia
## 20 Feature            6.6             53 km SE of Nikolski, Alaska
## 21 Feature            6.8            100 km SE of Nikolski, Alaska
## 22 Feature            6.6               48 km WNW of Pólis, Cyprus
## 23 Feature            6.2            south of the Kermadec Islands
## 24 Feature            6.6                  northern Qinghai, China
## 25 Feature            6.1              near the coast of Nicaragua
## 26 Feature            6.0            284 km E of Katabu, Indonesia
## 27 Feature            6.2          66 km E of Hualien City, Taiwan
## 28 Feature            6.0               110 km NW of Sola, Vanuatu
##    properties.time properties.updated properties.tz
## 1     1.645753e+12       1.654737e+12            NA
## 2     1.645510e+12       1.651672e+12            NA
## 3     1.645486e+12       1.651672e+12            NA
## 4     1.645043e+12       1.651328e+12            NA
## 5     1.644996e+12       1.651328e+12            NA
## 6     1.644784e+12       1.664138e+12            NA
## 7     1.644322e+12       1.659784e+12            NA
## 8     1.644006e+12       1.650045e+12            NA
## 9     1.643904e+12       1.650045e+12            NA
## 10    1.643744e+12       1.650045e+12            NA
## 11    1.643424e+12       1.650045e+12            NA
## 12    1.643368e+12       1.661111e+12            NA
## 13    1.643266e+12       1.649536e+12            NA
## 14    1.643074e+12       1.659790e+12            NA
## 15    1.642829e+12       1.663997e+12            NA
## 16    1.642818e+12       1.649536e+12            NA
## 17    1.642781e+12       1.653193e+12            NA
## 18    1.642338e+12       1.648835e+12            NA
## 19    1.642151e+12       1.647728e+12            NA
## 20    1.641905e+12       1.664283e+12            NA
```

```
## 21    1.641901e+12       1.664279e+12            NA
## 22    1.641863e+12       1.654661e+12            NA
## 23    1.641773e+12       1.659797e+12            NA
## 24    1.641578e+12       1.653025e+12            NA
## 25    1.641486e+12       1.650528e+12            NA
## 26    1.641330e+12       1.647124e+12            NA
## 27    1.641203e+12       1.648748e+12            NA
## 28    1.641176e+12       1.647124e+12            NA
##                                                 properties.url
## 1  https://earthquake.usgs.gov/earthquakes/eventpage/us6000gzyg
## 2  https://earthquake.usgs.gov/earthquakes/eventpage/us7000gmw3
## 3  https://earthquake.usgs.gov/earthquakes/eventpage/us7000gmtt
## 4  https://earthquake.usgs.gov/earthquakes/eventpage/us7000glex
## 5  https://earthquake.usgs.gov/earthquakes/eventpage/us7000gl8w
## 6  https://earthquake.usgs.gov/earthquakes/eventpage/us7000gklv
## 7  https://earthquake.usgs.gov/earthquakes/eventpage/us7000gj2g
## 8  https://earthquake.usgs.gov/earthquakes/eventpage/us7000gi25
## 9  https://earthquake.usgs.gov/earthquakes/eventpage/us7000ghm5
## 10 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gh1g
## 11 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gg3w
## 12 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gfti
## 13 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gfhb
## 14 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gery
## 15 https://earthquake.usgs.gov/earthquakes/eventpage/us7000ge5q
## 16 https://earthquake.usgs.gov/earthquakes/eventpage/us7000ge38
## 17 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gdwz
## 18 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gcfv
## 19 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gbu4
## 20 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gawk
## 21 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gavu
## 22 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gaqu
## 23 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gag3
## 24 https://earthquake.usgs.gov/earthquakes/eventpage/us7000g9zq
## 25 https://earthquake.usgs.gov/earthquakes/eventpage/us7000g9nb
## 26 https://earthquake.usgs.gov/earthquakes/eventpage/us7000g90c
## 27 https://earthquake.usgs.gov/earthquakes/eventpage/us7000g8n3
## 28 https://earthquake.usgs.gov/earthquakes/eventpage/us7000g8kq
##                                                                 properties.detail
## 1  https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us6000gzyg&format=geojson
## 2  https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gmw3&format=geojson
## 3  https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gmtt&format=geojson
## 4  https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000glex&format=geojson
## 5  https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gl8w&format=geojson
## 6  https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gklv&format=geojson
## 7  https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gj2g&format=geojson
## 8  https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gi25&format=geojson
## 9  https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000ghm5&format=geojson
## 10 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gh1g&format=geojson
## 11 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gg3w&format=geojson
## 12 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gfti&format=geojson
## 13 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gfhb&format=geojson
## 14 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gery&format=geojson
## 15 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000ge5q&format=geojson
## 16 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000ge38&format=geojson
```

```
## 17 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gdwz&format=geojson
## 18 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gcfv&format=geojson
## 19 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gbu4&format=geojson
## 20 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gawk&format=geojson
## 21 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gavu&format=geojson
## 22 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gaqu&format=geojson
## 23 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gag3&format=geojson
## 24 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000g9zq&format=geojson
## 25 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000g9nb&format=geojson
## 26 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000g90c&format=geojson
## 27 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000g8n3&format=geojson
## 28 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000g8kq&format=geojson
##    properties.felt properties.cdi properties.mmi properties.alert
## 1              212            9.1          6.930            green
## 2               15            4.1          3.539            green
## 3               NA             NA          3.926            green
## 4                1            2.2          3.057            green
## 5              431            7.5          5.996           yellow
## 6                4            2.7          3.446            green
## 7                8            4.3          0.000            green
## 8               NA             NA          0.000            green
## 9               53            7.6          5.803            green
## 10              10            6.9          4.374            green
## 11               2            7.1          3.687            green
## 12               7            6.2          3.444            green
## 13              NA             NA          3.660            green
## 14               1            2.0          3.401            green
## 15              23            3.9          5.308            green
## 16               7            4.1          5.849            green
## 17             105            7.5          6.516            green
## 18              NA             NA          2.819            green
## 19             140            8.2          6.200            green
## 20               5            7.9          5.381            green
## 21              28            6.5          6.389            green
## 22             486            6.3          5.555            green
## 23               1            4.1          4.622            green
## 24              14            8.5          8.434           orange
## 25              56            4.4          4.644            green
## 26               1            5.4          1.989            green
## 27              65            5.6          4.212            green
## 28               2            3.8          4.421            green
##    properties.status properties.tsunami properties.sig properties.net
## 1           reviewed                   0            765            us
## 2           reviewed                   0            560            us
## 3           reviewed                   0            611            us
## 4           reviewed                   1            712            us
## 5           reviewed                   0            973            us
## 6           reviewed                   0            555            us
## 7           reviewed                   0            595            us
## 8           reviewed                   0            611            us
## 9           reviewed                   0            690            us
## 10          reviewed                   0            561            us
## 11          reviewed                   1            651            us
## 12          reviewed                   0            558            us
```

```
## 13          reviewed                    0            591             us
## 14          reviewed                    0            554             us
## 15          reviewed                    1            600             us
## 16          reviewed                    0            557             us
## 17          reviewed                    1            689             us
## 18          reviewed                    0            572             us
## 19          reviewed                    0            785             us
## 20          reviewed                    1            674             us
## 21          reviewed                    1            730             us
## 22          reviewed                    0            976             us
## 23          reviewed                    0            592             us
## 24          reviewed                    0           1012             us
## 25          reviewed                    0            597             us
## 26          reviewed                    0            554             us
## 27          reviewed                    0            628             us
## 28          reviewed                    0            555             us
##    properties.code
## 1         6000gzyg
## 2         7000gmw3
## 3         7000gmtt
## 4         7000glex
## 5         7000gl8w
## 6         7000gklv
## 7         7000gj2g
## 8         7000gi25
## 9         7000ghm5
## 10        7000gh1g
## 11        7000gg3w
## 12        7000gfti
## 13        7000gfhb
## 14        7000gery
## 15        7000ge5q
## 16        7000ge38
## 17        7000gdwz
## 18        7000gcfv
## 19        7000gbu4
## 20        7000gawk
## 21        7000gavu
## 22        7000gaqu
## 23        7000gag3
## 24        7000g9zq
## 25        7000g9nb
## 26        7000g90c
## 27        7000g8n3
## 28        7000g8kq
##                                                    properties.ids
## 1               ,us6000gzyg,usauto6000gzyg,pt22056000,at00r7u7a0,
## 2               ,us7000gmw3,usauto7000gmw3,pt22053000,at00r7ozxe,
## 3               ,us7000gmtt,usauto7000gmtt,at00r7oh0b,pt22052001,
## 4               ,at00r7ez73,us7000glex,pt22047002,usauto7000glex,
## 5               ,us7000gl8w,usauto7000gl8w,at00r7dyop,pt22047001,
## 6               ,us7000gklv,usauto7000gklv,pt22044005,at00r79flo,
## 7               ,us7000gj2g,usauto7000gj2g,pt22039000,at00r6zin6,
## 8               ,usauto7000gi25,at00r6srdz,pt22035000,us7000gi25,
```

```
## 9               ,us7000ghm5,usauto7000ghm5,pt22034000,at00r6qke9,
## 10                        ,us7000gh1g,usauto7000gh1g,pt22032000,
## 11              ,pt22029000,us7000gg3w,at00r6gae1,usauto7000gg3w,
## 12              ,us7000gfti,usauto7000gfti,pt22028000,at00r6f37m,
## 13                        ,us7000gfhb,usauto7000gfhb,pt22027000,
## 14              ,us7000gery,usauto7000gery,pt22025000,at00r68rx3,
## 15 ,at00r63iof,us7000ge5q,usauto7000ge5q,pt22022001,ak02210gwcyq,
## 16              ,us7000ge38,usauto7000ge38,pt22022000,at00r63aru,
## 17              ,at00r62i6f,us7000gdwz,usauto7000gdwz,pt22021000,
## 18              ,us7000gcfv,usauto7000gcfv,pt22016000,at00r5szqy,
## 19              ,us7000gbu4,usauto7000gbu4,pt22014000,at00r5ozxj,
## 20  ,us7000gawk,at00r5jpu0,pt22011002,usauto7000gawk,ak022ieagfj,
## 21  ,at00r5jmvn,ak022ido6wm,us7000gavu,pt22011001,usauto7000gavu,
## 22              ,us7000gaqu,usauto7000gaqu,at00r5itt0,pt22011000,
## 23                           ,us7000gag3,at00r5gwau,pt22010000,
## 24              ,us7000g9zq,usauto7000g9zq,at00r5cpbx,pt22007000,
## 25              ,us7000g9nb,usauto7000g9nb,at00r5aqxv,pt22006001,
## 26                        ,us7000g90c,usauto7000g90c,pt22004053,
## 27                        ,us7000g8n3,usauto7000g8n3,pt22003001,
## 28                        ,us7000g8kq,usauto7000g8kq,pt22003000,
##      properties.sources
## 1     ,us,usauto,pt,at,
## 2     ,us,usauto,pt,at,
## 3     ,us,usauto,at,pt,
## 4     ,at,us,pt,usauto,
## 5     ,us,usauto,at,pt,
## 6     ,us,usauto,pt,at,
## 7     ,us,usauto,pt,at,
## 8     ,usauto,at,pt,us,
## 9     ,us,usauto,pt,at,
## 10       ,us,usauto,pt,
## 11    ,pt,us,at,usauto,
## 12    ,us,usauto,pt,at,
## 13       ,us,usauto,pt,
## 14    ,us,usauto,pt,at,
## 15 ,at,us,usauto,pt,ak,
## 16    ,us,usauto,pt,at,
## 17    ,at,us,usauto,pt,
## 18    ,us,usauto,pt,at,
## 19    ,us,usauto,pt,at,
## 20 ,us,at,pt,usauto,ak,
## 21 ,at,ak,us,pt,usauto,
## 22    ,us,usauto,at,pt,
## 23          ,us,at,pt,
## 24    ,us,usauto,at,pt,
## 25    ,us,usauto,at,pt,
## 26       ,us,usauto,pt,
## 27       ,us,usauto,pt,
## 28       ,us,usauto,pt,
##
## 1                                ,dyfi,ground-failure,impact-text,internal-moment-tensor,internal-ori
## 2                                           ,dyfi,ground-failure,internal-moment-tensor,internal-ori
## 3                                                                ,internal-moment-tensor,internal-ori
## 4                                ,dyfi,ground-failure,impact-link,internal-moment-tensor,internal-ori
```

```
## 5                                ,dyfi,ground-failure,impact-text,internal-moment-tensor,internal-ori
## 6                                       ,dyfi,ground-failure,internal-moment-tensor,internal-origin
## 7                                                  ,dyfi,internal-moment-tensor,internal-ori
## 8                                                       ,internal-moment-tensor,internal-ori
## 9                                ,dyfi,ground-failure,impact-text,internal-moment-tensor,internal-ori
## 10                                          ,dyfi,ground-failure,internal-moment-tensor,internal-ori
## 11        ,associate,dyfi,ground-failure,impact-link,impact-text,internal-moment-tensor,internal-ori
## 12                                          ,dyfi,ground-failure,internal-moment-tensor,internal-ori
## 13                                               ,ground-failure,internal-moment-tensor,internal-ori
## 14                                          ,dyfi,ground-failure,internal-moment-tensor,internal-ori
## 15                          ,dyfi,ground-failure,impact-link,internal-moment-tensor,internal-origin
## 16                              ,dyfi,ground-failure,impact-text,internal-moment-tensor,internal-ori
## 17                  ,dyfi,ground-failure,impact-link,impact-text,internal-moment-tensor,internal-ori
## 18                                          ,ground-failure,internal-moment-tensor,internal-ori
## 19                               ,dyfi,ground-failure,impact-text,internal-moment-tensor,internal-ori
## 20 ,dyfi,general-text,ground-failure,impact-link,internal-moment-tensor,internal-origin,losspager,mo
## 21              ,dyfi,general-text,ground-failure,impact-link,internal-moment-tensor,internal-origin
## 22                               ,dyfi,ground-failure,impact-text,internal-moment-tensor,internal-ori
## 23                                                                ,dyfi,ground-failure,internal-ori
## 24    ,dyfi,finite-fault,general-text,ground-failure,impact-text,internal-moment-tensor,internal-ori
## 25                                          ,dyfi,ground-failure,internal-moment-tensor,internal-ori
## 26                                          ,dyfi,ground-failure,internal-moment-tensor,internal-ori
## 27                               ,dyfi,ground-failure,impact-text,internal-moment-tensor,internal-ori
## 28                                          ,dyfi,ground-failure,internal-moment-tensor,internal-ori
##    properties.nst properties.dmin properties.rms properties.gap
## 1              NA           0.945           1.37             25
## 2              NA           1.787           0.42             33
## 3              NA           7.847           0.75             18
## 4              NA           5.780           0.95             12
## 5              NA           1.129           1.11             32
## 6              NA           1.878           0.94             42
## 7              NA           9.280           0.41             35
## 8              NA          18.979           0.62             41
## 9              NA           3.026           0.72             22
## 10             NA           3.000           0.80             14
## 11             NA           1.088           1.30             57
## 12             NA           3.277           0.46             57
## 13             NA           5.069           0.51             45
## 14             NA           4.586           0.84             27
## 15             NA           0.566           0.94             95
## 16             NA           2.966           0.96             34
## 17             NA           1.813           1.11             25
## 18             NA           3.469           0.66             20
## 19             NA           2.418           0.54             22
## 20             NA           0.507           0.52             49
## 21             NA           0.920           0.56             61
## 22             NA           1.168           0.71             21
## 23             NA           4.892           1.21             55
## 24             NA           2.685           0.69             13
## 25             NA           0.732           1.24             43
## 26             NA           4.393           0.99             10
## 27             NA           0.629           0.90             66
## 28             NA           2.278           1.18             33
##    properties.magType properties.type
```

```
## 1                 mww      earthquake
## 2                 mww      earthquake
## 3                 mww      earthquake
## 4                 mww      earthquake
## 5                 mww      earthquake
## 6                 mww      earthquake
## 7                 mww      earthquake
## 8                 mww      earthquake
## 9                 mww      earthquake
## 10                mww      earthquake
## 11                mww      earthquake
## 12                mww      earthquake
## 13                mww      earthquake
## 14                mww      earthquake
## 15                mww      earthquake
## 16                mww      earthquake
## 17                mww      earthquake
## 18                mww      earthquake
## 19                mww      earthquake
## 20                mww      earthquake
## 21                mww      earthquake
## 22                mww      earthquake
## 23                mww      earthquake
## 24                mww      earthquake
## 25                mww      earthquake
## 26                mww      earthquake
## 27                mww      earthquake
## 28                mww      earthquake
##                                   properties.title geometry.type
## 1       M 6.1 - 65 km NNW of Bukittinggi, Indonesia         Point
## 2          M 6.0 - 58 km W of Abra Pampa, Argentina         Point
## 3                   M 6.3 - Balleny Islands region         Point
## 4                 M 6.8 - south of the Fiji Islands         Point
## 5  M 6.2 - 12 km WSW of Nueva Concepción, Guatemala         Point
## 6        M 6.0 - 168 km SSW of Merizo Village, Guam         Point
## 7                 M 6.2 - central Mid-Atlantic Ridge         Point
## 8                     M 6.3 - southeast Indian Ridge         Point
## 9                 M 6.5 - 49 km NW of Barranca, Peru         Point
## 10       M 6.0 - 184 km NE of Lospalos, Timor Leste         Point
## 11                  M 6.5 - Kermadec Islands region         Point
## 12              M 6.0 - 281 km SW of Arenas, Panama         Point
## 13              M 6.2 - 220 km WNW of Pangai, Tonga         Point
## 14            M 6.0 - South Sandwich Islands region         Point
## 15              M 6.2 - 71 km S of Unalaska, Alaska         Point
## 16      M 6.0 - 232 km SE of Sarangani, Philippines         Point
## 17                M 6.3 - 27 km SSE of Saiki, Japan         Point
## 18   M 6.1 - 74 km WSW of Panguna, Papua New Guinea         Point
## 19            M 6.6 - 80 km SW of Labuan, Indonesia         Point
## 20             M 6.6 - 53 km SE of Nikolski, Alaska         Point
## 21            M 6.8 - 100 km SE of Nikolski, Alaska         Point
## 22               M 6.6 - 48 km WNW of Pólis, Cyprus         Point
## 23            M 6.2 - south of the Kermadec Islands         Point
## 24                  M 6.6 - northern Qinghai, China         Point
## 25              M 6.1 - near the coast of Nicaragua         Point
```

```
## 26            M 6.0 - 284 km E of Katabu, Indonesia         Point
## 27          M 6.2 - 66 km E of Hualien City, Taiwan         Point
## 28               M 6.0 - 110 km NW of Sola, Vanuatu         Point
##            geometry.coordinates         id
## 1      100.1006, 0.2190, 4.0000 us6000gzyg
## 2  -66.2663, -22.6664, 251.0000 us7000gmw3
## 3   165.3918, -69.7739, 14.0000 us7000gmtt
## 4  179.9981, -23.7682, 535.0000 us7000glex
## 5    -91.3982, 14.1476, 60.0000 us7000gl8w
## 6    144.2842, 11.7884, 15.0000 us7000gklv
## 7    -19.8913, -0.4170, 10.0000 us7000gj2g
## 8    99.4949, -48.0330, 10.0000 us7000gi25
## 9   -76.9283, -4.4661, 110.0000 us7000ghm5
## 10  128.3132, -7.4830, 119.0000 us7000gh1g
## 11  -176.7217, -29.5642, 8.0000 us7000gg3w
## 12     -82.5844, 5.4966, 8.0000 us7000gfti
## 13  -176.3135, -19.0992, 6.2000 us7000gfhb
## 14  -28.7839, -55.3696, 11.0000 us7000gery
## 15  -166.6820, 53.2402, 29.0000 us7000ge5q
## 16    126.6596, 3.6724, 21.0000 us7000ge38
## 17   132.0386, 32.7282, 39.0000 us7000gdwz
## 18  154.8224, -6.4492, 379.0000 us7000gcfv
## 19   105.2887, -6.8600, 33.0000 us7000gbu4
## 20  -168.3275, 52.5791, 19.0000 us7000gawk
## 21  -167.7554, 52.3415, 20.0000 us7000gavu
## 22    31.9435, 35.2267, 21.0000 us7000gaqu
## 23   179.5740, -33.7823, 7.0000 us7000gag3
## 24   101.2900, 37.8283, 13.0000 us7000g9zq
## 25   -87.1371, 11.9367, 17.0000 us7000g9nb
## 26  125.0808, -4.8065, 544.0000 us7000g90c
## 27   122.2592, 24.0079, 19.0000 us7000g8n3
## 28 166.8148, -13.1864, 104.0000 us7000g8kq
##
## $bbox
## [1] -176.7217  -69.7739    4.0000  179.9981   53.2402  544.0000
```

```
names(earthquake)
```

```
## [1] "type"     "metadata" "features" "bbox"
```

Problem 2

As you noticed, the `earthquake` data stores information on earthquakes that happened between January and February of 2022, according to the United States Geological Survey (USGS). Try to explore the data a little bit. Can you tell in which key the main data is stored? Show the code you used to find the answer and explain your reasoning. Additional documentation about this file is available at the USGS API documentation.

`earthquake$features` contains the main features.

```
#write your code here
head(earthquake$features)
```

```
##      type properties.mag                          properties.place
```

```
## 1 Feature            6.1      65 km NNW of Bukittinggi, Indonesia
## 2 Feature            6.0         58 km W of Abra Pampa, Argentina
## 3 Feature            6.3                  Balleny Islands region
## 4 Feature            6.8               south of the Fiji Islands
## 5 Feature            6.2 12 km WSW of Nueva Concepción, Guatemala
## 6 Feature            6.0       168 km SSW of Merizo Village, Guam
##   properties.time properties.updated properties.tz
## 1    1.645753e+12       1.654737e+12            NA
## 2    1.645510e+12       1.651672e+12            NA
## 3    1.645486e+12       1.651672e+12            NA
## 4    1.645043e+12       1.651328e+12            NA
## 5    1.644996e+12       1.651328e+12            NA
## 6    1.644784e+12       1.664138e+12            NA
##                                            properties.url
## 1 https://earthquake.usgs.gov/earthquakes/eventpage/us6000gzyg
## 2 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gmw3
## 3 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gmtt
## 4 https://earthquake.usgs.gov/earthquakes/eventpage/us7000glex
## 5 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gl8w
## 6 https://earthquake.usgs.gov/earthquakes/eventpage/us7000gklv
##                                                                properties.detail
## 1 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us6000gzyg&format=geojson
## 2 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gmw3&format=geojson
## 3 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gmtt&format=geojson
## 4 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000glex&format=geojson
## 5 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gl8w&format=geojson
## 6 https://earthquake.usgs.gov/fdsnws/event/1/query?eventid=us7000gklv&format=geojson
##   properties.felt properties.cdi properties.mmi properties.alert
## 1             212            9.1          6.930            green
## 2              15            4.1          3.539            green
## 3              NA             NA          3.926            green
## 4               1            2.2          3.057            green
## 5             431            7.5          5.996           yellow
## 6               4            2.7          3.446            green
##   properties.status properties.tsunami properties.sig properties.net
## 1          reviewed                  0            765             us
## 2          reviewed                  0            560             us
## 3          reviewed                  0            611             us
## 4          reviewed                  1            712             us
## 5          reviewed                  0            973             us
## 6          reviewed                  0            555             us
##   properties.code                                  properties.ids
## 1        6000gzyg ,us6000gzyg,usauto6000gzyg,pt22056000,at00r7u7a0,
## 2        7000gmw3 ,us7000gmw3,usauto7000gmw3,pt22053000,at00r7ozxe,
## 3        7000gmtt ,us7000gmtt,usauto7000gmtt,at00r7oh0b,pt22052001,
## 4        7000glex ,at00r7ez73,us7000glex,pt22047002,usauto7000glex,
## 5        7000gl8w ,us7000gl8w,usauto7000gl8w,at00r7dyop,pt22047001,
## 6        7000gklv ,us7000gklv,usauto7000gklv,pt22044005,at00r79flo,
##   properties.sources
## 1  ,us,usauto,pt,at,
## 2  ,us,usauto,pt,at,
## 3  ,us,usauto,at,pt,
## 4  ,at,us,pt,usauto,
## 5  ,us,usauto,at,pt,
```

```
## 6  ,us,usauto,pt,at,
##
## 1 ,dyfi,ground-failure,impact-text,internal-moment-tensor,internal-origin,losspager,moment-tensor,ori
## 2             ,dyfi,ground-failure,internal-moment-tensor,internal-origin,losspager,moment-tensor,ori
## 3                                  ,internal-moment-tensor,internal-origin,losspager,moment-tensor,ori
## 4 ,dyfi,ground-failure,impact-link,internal-moment-tensor,internal-origin,losspager,moment-tensor,ori
## 5 ,dyfi,ground-failure,impact-text,internal-moment-tensor,internal-origin,losspager,moment-tensor,ori
## 6         ,dyfi,ground-failure,internal-moment-tensor,internal-origin,losspager,moment-tensor,oaf,ori
##   properties.nst properties.dmin properties.rms properties.gap
## 1             NA           0.945           1.37             25
## 2             NA           1.787           0.42             33
## 3             NA           7.847           0.75             18
## 4             NA           5.780           0.95             12
## 5             NA           1.129           1.11             32
## 6             NA           1.878           0.94             42
##   properties.magType properties.type
## 1                mww      earthquake
## 2                mww      earthquake
## 3                mww      earthquake
## 4                mww      earthquake
## 5                mww      earthquake
## 6                mww      earthquake
##                                   properties.title geometry.type
## 1      M 6.1 - 65 km NNW of Bukittinggi, Indonesia         Point
## 2         M 6.0 - 58 km W of Abra Pampa, Argentina         Point
## 3                   M 6.3 - Balleny Islands region         Point
## 4                 M 6.8 - south of the Fiji Islands         Point
## 5 M 6.2 - 12 km WSW of Nueva Concepción, Guatemala         Point
## 6       M 6.0 - 168 km SSW of Merizo Village, Guam         Point
##           geometry.coordinates         id
## 1     100.1006, 0.2190, 4.0000 us6000gzyg
## 2 -66.2663, -22.6664, 251.0000 us7000gmw3
## 3  165.3918, -69.7739, 14.0000 us7000gmtt
## 4 179.9981, -23.7682, 535.0000 us7000glex
## 5   -91.3982, 14.1476, 60.0000 us7000gl8w
## 6   144.2842, 11.7884, 15.0000 us7000gklv
```

Problem 3

Although the dataset has many interesting information on the earthquakes, we are mainly interested in the following: `place` where the earthquake occurred, the date when it occurred (expressed in `time` and stored in milliseconds–ISO8601 format), the `magnitude`, and whether or not it caused a `tsunami`. We want to create a dataframe that has only these columns. Below you'll find an excerpt of the the file that show how this data is stored:

```
"features": [
    {
      "type": "Feature",
      "properties": {
        "mag": 6.2,
        "place": "66 km E of Hualien City, Taiwan",
        "time": 1641203195767,
        ...
```

```
"tsunami": 0,
...
```

a. Create four variables to store the arrays with the data we're interested in. Name these variables as `place`, `date`, `magnitude`, and `tsunami`. Use the `earthquake$...` syntax to find the data we want and attribute the values to each variable. At the end of this step, each variable must be a vector with 28 observations each.

```
# write your code here
place <- earthquake$features$properties$place
date <- earthquake$features$properties$time
magnitude <- earthquake$features$properties$mag
tsunami <- earthquake$features$properties$tsunami
```

b. Create a dataframe with the four variables from the previous step. Because the four variables are atomic arrays, you can `cbind` them into a dataframe. Your dataframe must be named `eq.df`.

```
# write your code here
eq.df <- data.frame(cbind(
  place, date, magnitude, tsunami
))
```

c. Check the structure of you new dataframe (`eq.df`). There are two important changes we need to make in this dataframe. The first (and easier) one is to change the `tsunami` data type from numeric to factor (where the numbers 0 and 1 stands for the categories False/True, respectively). The second one is trickier. To make `date` more readable, we need to transform it into a `Date` type. ISO 8601 format includes date, time and timezone (the default is UTC) but we are not interested in these data, we want to know the date only. Here is what you're going to do:

- the values in `date` are in milliseconds. The function we'll use takes in values in seconds. Thus, the first step is to divide `date` by `1000`, so that we have the values in seconds;
- call the function `as_datetime()` from the `lubridate` package to convert the date in seconds to date-time-timezone format;
- finally, call the function `as_date()` from the `lubridate` package to converte the date-time-timezone format to date only.

Check the structure of the dataframe again. You've done it correctly if your `tsunami` variable is a 2-levels factor "0", "1", and the `date` variable shows a date in the format `YYYY-MM-DD`.

```
# turn tsunami into a factor
eq.df$tsunami <- as.factor(eq.df$tsunami)
eq.df$date <- as_date(as_datetime(date / 1000))
```

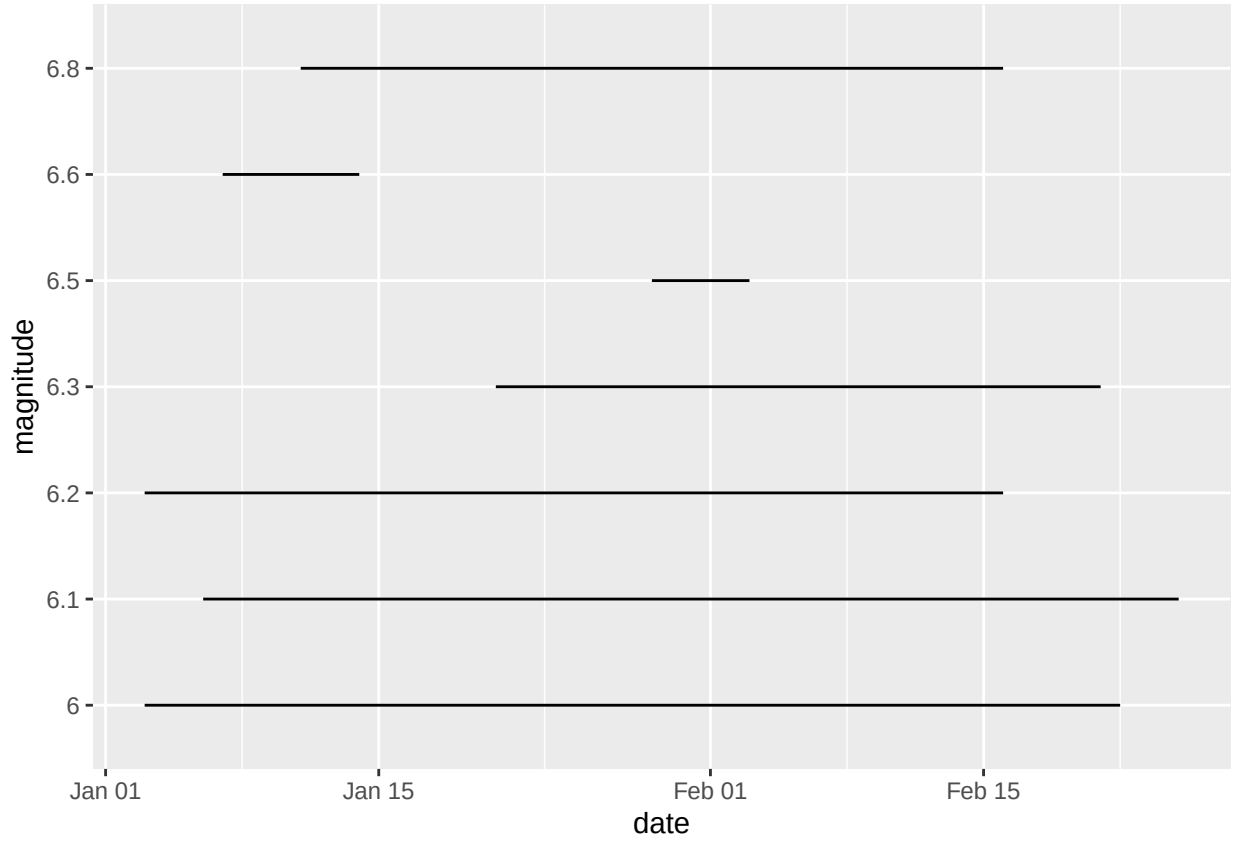
Problem 4

Now that we have our dataset of interest, let's plot some data! Follow these steps:

a. Use `geom_line()` function to show a timeline of the earthquake's magnitudes (`magnitude` per `date`). When the earthquakes with the highest magnitude happened? Discuss it.

A 6.8 earthquake happened on 1/11 and 2/16.

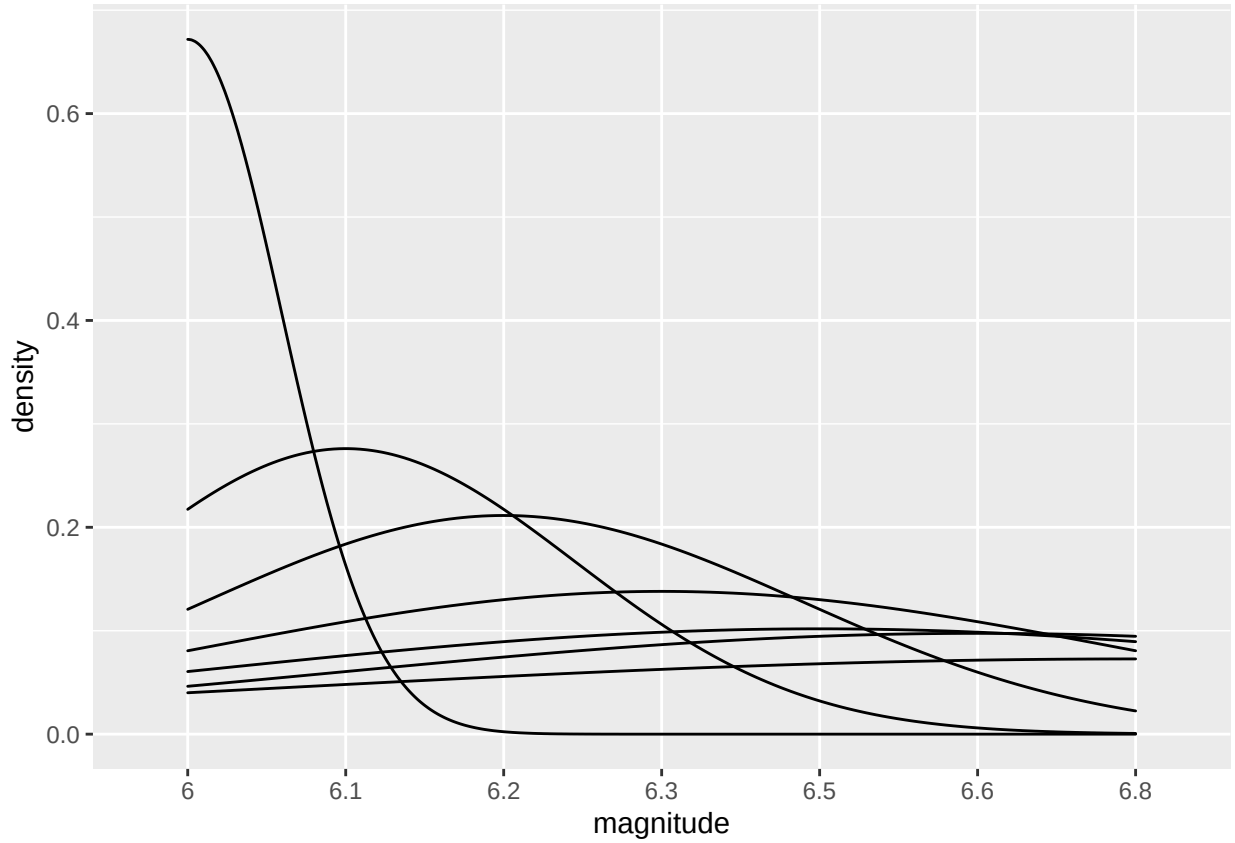
```
# write your code here
ggplot(eq.df, aes(x=date,y=magnitude)) +
  geom_line()
```



b. Create a plot to show the density of the magnitudes. Discuss the trend you see in the plot: what range of magnitudes were most common?

6.0 is the most common.

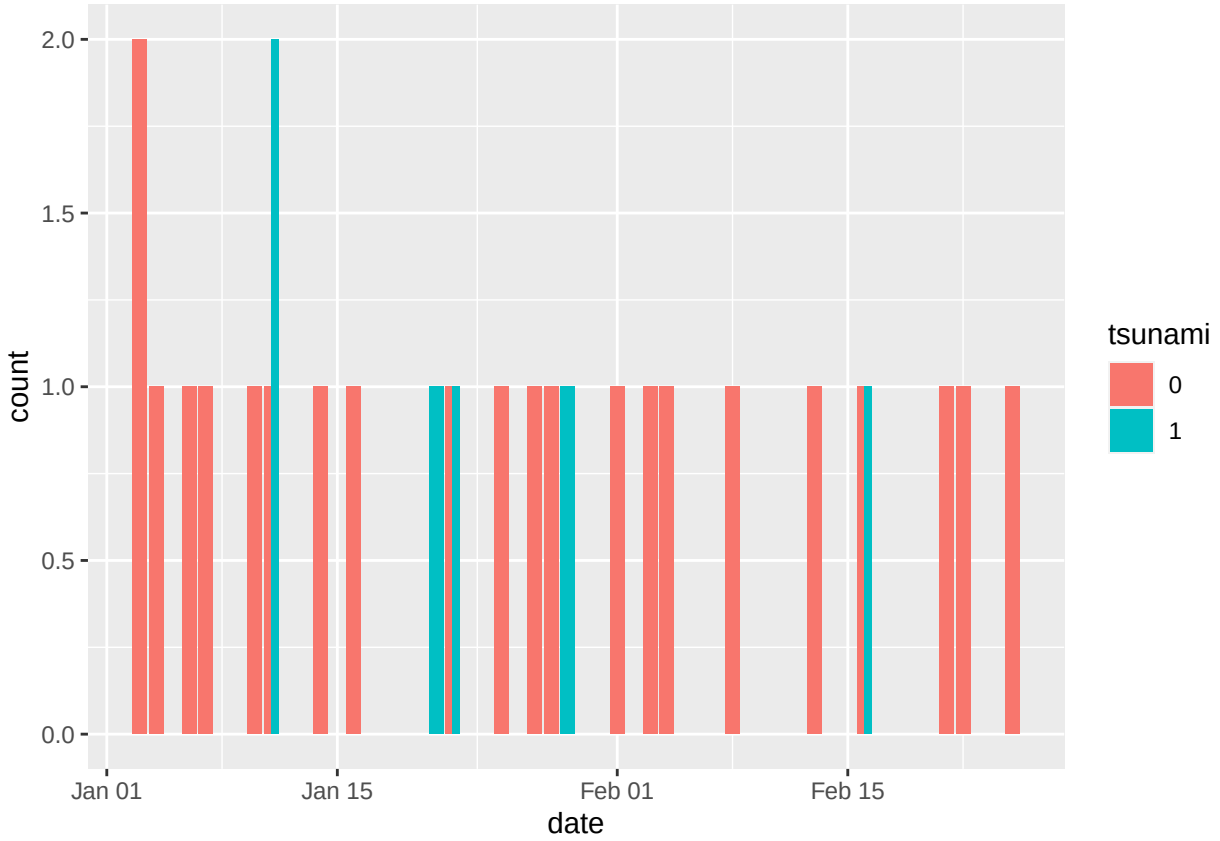
```
# write your code here
ggplot(eq.df)+
  geom_density(aes(x=magnitude))
```



c. Create a bar plot to show the tsunami occurrences. What can we observe about the relation between tsunami occurrences and the earthquakes that happened at the beginning of this year?

The earthquakes don't look like they caused any tsunamis, except for the 6.8 earthquake on 1/11.

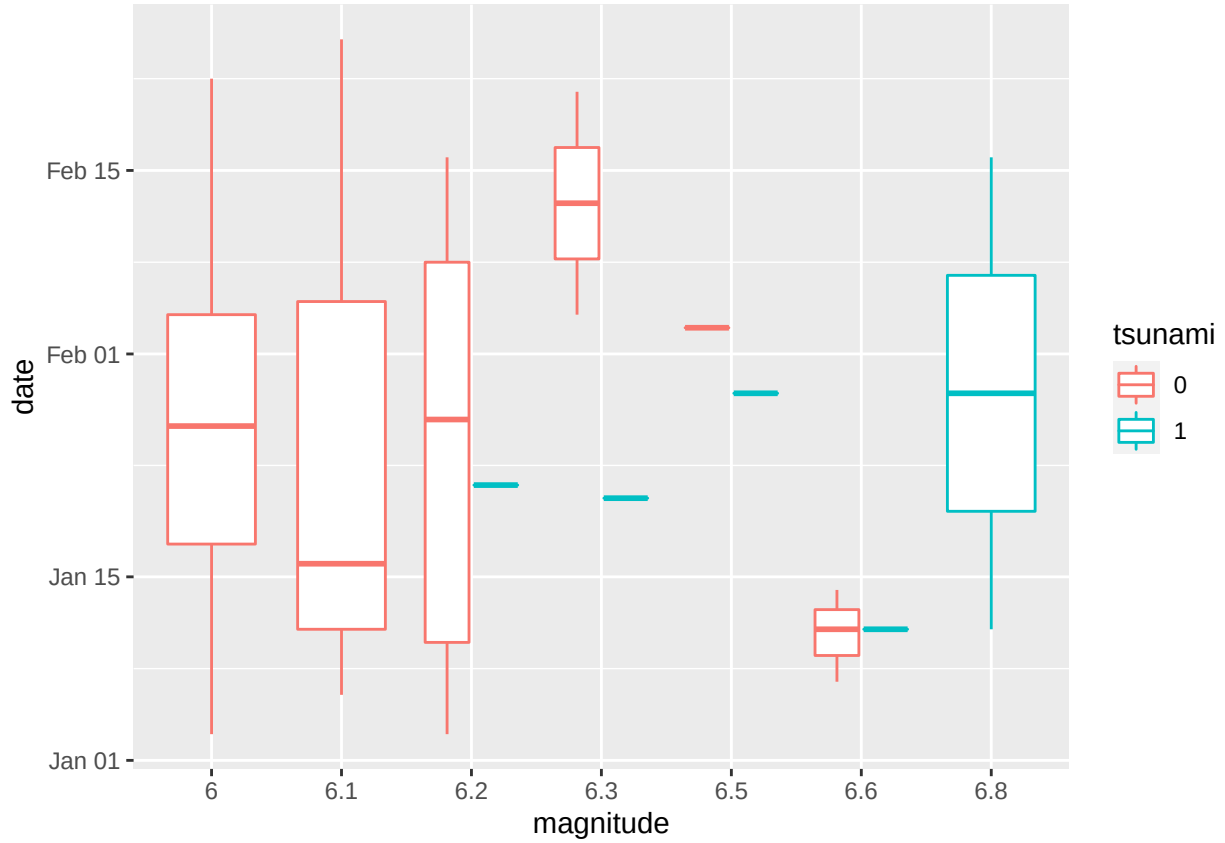
```
# write your code here
ggplot(eq.df) +
  geom_bar(aes(x=date, fill = tsunami), position = "dodge")
```



d. Create a boxplot to show the relationship of tsunami occurrences and earthquake's manitude. Considering only what you see in the plot (ignore you general knowledge on earthquakes and tsunimis), would you argue on using the magnitude to predict the ocurrences of tsunamis? Explain your reasoning.

Higher magnitude earthquakes are more likely to cause a tsunami.

```
ggplot(eq.df) +
  geom_boxplot(aes(x=magnitude, y = date, color = tsunami))
```

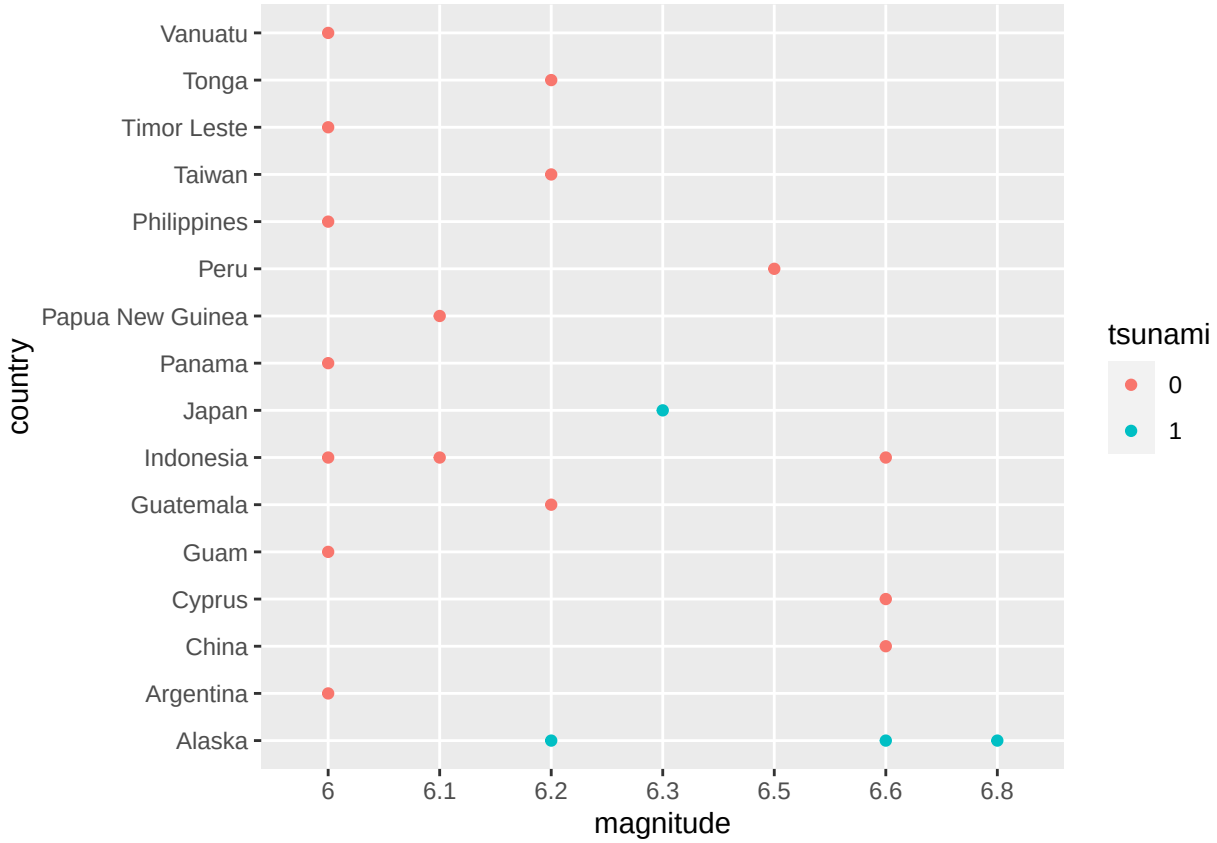


Extra credit (10 points toward Quiz rubric): can you figure how to extract **most** of the countries from the `places` variable? If you can, then cbind a dataframe with the columns `country` and `magnitude`. Create a visualization for the `magnitude` per `country`. Which of the countries had the earthquakes with higher magnitude?

Tip: Filter out the rows where country was not identified. I'm expecting you to easily identify around 20 counties (out of 28).

Alaska had the largest earthquake.

```
eq.df$country <- str_split_fixed(eq.df$place, "\\, ", n=2)[,2]
ggplot(filter(eq.df, country != "")) +
  geom_point(aes(y=country, x=magnitude, color=tsunami))
```


Vanuatu
Tonga
Timor Leste
Taiwan
Philippines
Peru
Papua New Guinea
Panama
Japan
Indonesia
Guatemala
Guam
Cyprus
China
Argentina
Alaska
country
6
6.1
6.2
6.3
6.5
6.6
6.8
magnitude
tsunami
0
1