lab3

Лабораторная работа 3

Задачи для лабораторной:

- работа с текстом;
- использование регулярных выражений для извлечения данных;
- переписывание существующего кода;
- ассиметричные распределения.

Исходные данные

Файл *forbes.htm* содержит список богатейших американцев по версии журнала Форбс. На его примере потренируемся в разборе html страниц.

Задание 1

1. Используйте команду `readLines` для загрузки файла в текстовый вектор *html*.

```
html <- readLines("https://raw.githubusercontent.com/SergeyMirvoda/MD-DA-2017/master/data/forbes.htm");
```

1. Сколько строк в файле?

```
length(html)
```

```
## [1] 1991
```

2. Сколько символов в файле?

```
sum(nchar(html))
```

```
## [1] 80380
```

2. Откройте файл в текстовом редакторе. Найдите строки, содержащие данные о Билле Гейтсе и Ларри Эллисоне и запомните размер их дохода.

1 Bill Gates


$72 B

3 Larry Ellison

 $41 B

3. Напишите шаблон регулярного выражения и используйте функцию `grep` , чтобы извлечь размер дохода из данных в векторе *html*. Удостоверьтесь, что полученный вектор номеров строк содержит содержит ровно 100 записей и ссылается на номера строк в котрых действительно есть информация о доходе, а не просто первый попавшийся текст.

```
#<td class="worth">$72 B</td>
#worth.value <- grep('<td class="worth">\\$[\\d,]* B</td>', html, value=TRUE, perl=TRUE)
#короче
worth.str <- grep('\\$[\\d,]* B', html, value=TRUE, perl=TRUE)
worth.str
```

```
##   [1] "\t\t<td class=\"worth\">$72 B</td>"
##   [2] "\t\t<td class=\"worth\">$58,5 B</td>"
##   [3] "\t\t<td class=\"worth\">$41 B</td>"
##   [4] "\t\t<td class=\"worth\">$36 B</td>"
##   [5] "\t\t<td class=\"worth\">$36 B</td>"
##   [6] "\t\t<td class=\"worth\">$35,4 B</td>"
##   [7] "\t\t<td class=\"worth\">$33,8 B</td>"
##   [8] "\t\t<td class=\"worth\">$33,5 B</td>"
##   [9] "\t\t<td class=\"worth\">$33,3 B</td>"
##  [10] "\t\t<td class=\"worth\">$31 B</td>"
##  [11] "\t\t<td class=\"worth\">$28,5 B</td>"
##  [12] "\t\t<td class=\"worth\">$27,2 B</td>"
##  [13] "\t\t<td class=\"worth\">$24,9 B</td>"
##  [14] "\t\t<td class=\"worth\">$24,4 B</td>"
##  [15] "\t\t<td class=\"worth\">$20,5 B</td>"
##  [16] "\t\t<td class=\"worth\">$20,5 B</td>"
##  [17] "\t\t<td class=\"worth\">$20,5 B</td>"
##  [18] "\t\t<td class=\"worth\">$20,3 B</td>"
##  [19] "\t\t<td class=\"worth\">$20 B</td>"
##  [20] "\t\t<td class=\"worth\">$19 B</td>"
##  [21] "\t\t<td class=\"worth\">$18 B</td>"
##  [22] "\t\t<td class=\"worth\">$17,8 B</td>"
##  [23] "\t\t<td class=\"worth\">$17,2 B</td>"
##  [24] "\t\t<td class=\"worth\">$16,3 B</td>"
##  [25] "\t\t<td class=\"worth\">$15,9 B</td>"
##  [26] "\t\t<td class=\"worth\">$15,8 B</td>"
##  [27] "\t\t<td class=\"worth\">$14 B</td>"
##  [28] "\t\t<td class=\"worth\">$14 B</td>"
##  [29] "\t\t<td class=\"worth\">$13,5 B</td>"
##  [30] "\t\t<td class=\"worth\">$13,4 B</td>"
##  [31] "\t\t<td class=\"worth\">$12,9 B</td>"
##  [32] "\t\t<td class=\"worth\">$12,5 B</td>"
##  [33] "\t\t<td class=\"worth\">$12,4 B</td>"
##  [34] "\t\t<td class=\"worth\">$12 B</td>"
##  [35] "\t\t<td class=\"worth\">$11,7 B</td>"
##  [36] "\t\t<td class=\"worth\">$11,4 B</td>"
##  [37] "\t\t<td class=\"worth\">$11,4 B</td>"
##  [38] "\t\t<td class=\"worth\">$10,3 B</td>"
##  [39] "\t\t<td class=\"worth\">$10,2 B</td>"
##  [40] "\t\t<td class=\"worth\">$10 B</td>"
##  [41] "\t\t<td class=\"worth\">$10 B</td>"
##  [42] "\t\t<td class=\"worth\">$9,8 B</td>"
##  [43] "\t\t<td class=\"worth\">$9,4 B</td>"
##  [44] "\t\t<td class=\"worth\">$9,3 B</td>"
##  [45] "\t\t<td class=\"worth\">$9 B</td>"
##  [46] "\t\t<td class=\"worth\">$8,9 B</td>"
##  [47] "\t\t<td class=\"worth\">$8,5 B</td>"
##  [48] "\t\t<td class=\"worth\">$8,5 B</td>"
##  [49] "\t\t<td class=\"worth\">$8,3 B</td>"
##  [50] "\t\t<td class=\"worth\">$8,3 B</td>"
##  [51] "\t\t<td class=\"worth\">$8,3 B</td>"
##  [52] "\t\t<td class=\"worth\">$8,2 B</td>"
##  [53] "\t\t<td class=\"worth\">$7,9 B</td>"
```

```
##  [54] "\t\t<td class=\"worth\">$7,7 B</td>"
##  [55] "\t\t<td class=\"worth\">$7,7 B</td>"
##  [56] "\t\t<td class=\"worth\">$7,6 B</td>"
##  [57] "\t\t<td class=\"worth\">$7,5 B</td>"
##  [58] "\t\t<td class=\"worth\">$7,2 B</td>"
##  [59] "\t\t<td class=\"worth\">$6,9 B</td>"
##  [60] "\t\t<td class=\"worth\">$6,8 B</td>"
##  [61] "\t\t<td class=\"worth\">$6,7 B</td>"
##  [62] "\t\t<td class=\"worth\">$6,7 B</td>"
##  [63] "\t\t<td class=\"worth\">$6,7 B</td>"
##  [64] "\t\t<td class=\"worth\">$6,7 B</td>"
##  [65] "\t\t<td class=\"worth\">$6,4 B</td>"
##  [66] "\t\t<td class=\"worth\">$6,4 B</td>"
##  [67] "\t\t<td class=\"worth\">$6,4 B</td>"
##  [68] "\t\t<td class=\"worth\">$6 B</td>"
##  [69] "\t\t<td class=\"worth\">$6 B</td>"
##  [70] "\t\t<td class=\"worth\">$5,9 B</td>"
##  [71] "\t\t<td class=\"worth\">$5,8 B</td>"
##  [72] "\t\t<td class=\"worth\">$5,8 B</td>"
##  [73] "\t\t<td class=\"worth\">$5,7 B</td>"
##  [74] "\t\t<td class=\"worth\">$5,6 B</td>"
##  [75] "\t\t<td class=\"worth\">$5,6 B</td>"
##  [76] "\t\t<td class=\"worth\">$5,6 B</td>"
##  [77] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [78] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [79] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [80] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [81] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [82] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [83] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [84] "\t\t<td class=\"worth\">$5,3 B</td>"
##  [85] "\t\t<td class=\"worth\">$5,2 B</td>"
##  [86] "\t\t<td class=\"worth\">$5,2 B</td>"
##  [87] "\t\t<td class=\"worth\">$5,2 B</td>"
##  [88] "\t\t<td class=\"worth\">$5,1 B</td>"
##  [89] "\t\t<td class=\"worth\">$5,1 B</td>"
##  [90] "\t\t<td class=\"worth\">$5 B</td>"
##  [91] "\t\t<td class=\"worth\">$5 B</td>"
##  [92] "\t\t<td class=\"worth\">$5 B</td>"
##  [93] "\t\t<td class=\"worth\">$4,9 B</td>"
##  [94] "\t\t<td class=\"worth\">$4,8 B</td>"
##  [95] "\t\t<td class=\"worth\">$4,7 B</td>"
##  [96] "\t\t<td class=\"worth\">$4,7 B</td>"
##  [97] "\t\t<td class=\"worth\">$4,7 B</td>"
##  [98] "\t\t<td class=\"worth\">$4,6 B</td>"
##  [99] "\t\t<td class=\"worth\">$4,6 B</td>"
## [100] "\t\t<td class=\"worth\">$4,6 B</td>"
```

```
worth.num <- grep('\\$[\\d,]* B', html, perl=TRUE)
worth.num
```

```
##   [1]  547  557  567  577  587  597  607  617  627  637  647  657  667  677
##  [15]  687  697  707  717  727  737  747  757  767  777  787  797  807  817
##  [29]  827  837  847  857  867  877  887  897  907  917  927  937  947  957
##  [43]  967  977  987  997 1007 1017 1027 1037 1047 1057 1067 1077 1087 1097
##  [57] 1107 1117 1127 1137 1147 1157 1167 1177 1187 1197 1207 1217 1227 1237
##  [71] 1247 1257 1267 1277 1287 1297 1307 1317 1327 1337 1347 1357 1367 1377
##  [85] 1387 1397 1407 1417 1427 1437 1447 1457 1467 1477 1487 1497 1507 1517
##  [99] 1527 1537
```

```
length(worth.str)
```

```
## [1] 100
```

```
length(worth.num)
```

```
## [1] 100
```

```
html[worth.num]
```

```
##   [1] "\t\t<td class=\"worth\">$72 B</td>"
##   [2] "\t\t<td class=\"worth\">$58,5 B</td>"
##   [3] "\t\t<td class=\"worth\">$41 B</td>"
##   [4] "\t\t<td class=\"worth\">$36 B</td>"
##   [5] "\t\t<td class=\"worth\">$36 B</td>"
##   [6] "\t\t<td class=\"worth\">$35,4 B</td>"
##   [7] "\t\t<td class=\"worth\">$33,8 B</td>"
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##  [16] "\t\t<td class=\"worth\">$20,5 B</td>"
##  [17] "\t\t<td class=\"worth\">$20,5 B</td>"
##  [18] "\t\t<td class=\"worth\">$20,3 B</td>"
##  [19] "\t\t<td class=\"worth\">$20 B</td>"
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##  [21] "\t\t<td class=\"worth\">$18 B</td>"
##  [22] "\t\t<td class=\"worth\">$17,8 B</td>"
##  [23] "\t\t<td class=\"worth\">$17,2 B</td>"
##  [24] "\t\t<td class=\"worth\">$16,3 B</td>"
##  [25] "\t\t<td class=\"worth\">$15,9 B</td>"
##  [26] "\t\t<td class=\"worth\">$15,8 B</td>"
##  [27] "\t\t<td class=\"worth\">$14 B</td>"
##  [28] "\t\t<td class=\"worth\">$14 B</td>"
##  [29] "\t\t<td class=\"worth\">$13,5 B</td>"
##  [30] "\t\t<td class=\"worth\">$13,4 B</td>"
##  [31] "\t\t<td class=\"worth\">$12,9 B</td>"
##  [32] "\t\t<td class=\"worth\">$12,5 B</td>"
##  [33] "\t\t<td class=\"worth\">$12,4 B</td>"
##  [34] "\t\t<td class=\"worth\">$12 B</td>"
##  [35] "\t\t<td class=\"worth\">$11,7 B</td>"
##  [36] "\t\t<td class=\"worth\">$11,4 B</td>"
##  [37] "\t\t<td class=\"worth\">$11,4 B</td>"
##  [38] "\t\t<td class=\"worth\">$10,3 B</td>"
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##  [41] "\t\t<td class=\"worth\">$10 B</td>"
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##  [43] "\t\t<td class=\"worth\">$9,4 B</td>"
##  [44] "\t\t<td class=\"worth\">$9,3 B</td>"
##  [45] "\t\t<td class=\"worth\">$9 B</td>"
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##  [47] "\t\t<td class=\"worth\">$8,5 B</td>"
##  [48] "\t\t<td class=\"worth\">$8,5 B</td>"
##  [49] "\t\t<td class=\"worth\">$8,3 B</td>"
##  [50] "\t\t<td class=\"worth\">$8,3 B</td>"
##  [51] "\t\t<td class=\"worth\">$8,3 B</td>"
##  [52] "\t\t<td class=\"worth\">$8,2 B</td>"
##  [53] "\t\t<td class=\"worth\">$7,9 B</td>"
```

```
##  [54] "\t\t<td class=\"worth\">$7,7 B</td>"
##  [55] "\t\t<td class=\"worth\">$7,7 B</td>"
##  [56] "\t\t<td class=\"worth\">$7,6 B</td>"
##  [57] "\t\t<td class=\"worth\">$7,5 B</td>"
##  [58] "\t\t<td class=\"worth\">$7,2 B</td>"
##  [59] "\t\t<td class=\"worth\">$6,9 B</td>"
##  [60] "\t\t<td class=\"worth\">$6,8 B</td>"
##  [61] "\t\t<td class=\"worth\">$6,7 B</td>"
##  [62] "\t\t<td class=\"worth\">$6,7 B</td>"
##  [63] "\t\t<td class=\"worth\">$6,7 B</td>"
##  [64] "\t\t<td class=\"worth\">$6,7 B</td>"
##  [65] "\t\t<td class=\"worth\">$6,4 B</td>"
##  [66] "\t\t<td class=\"worth\">$6,4 B</td>"
##  [67] "\t\t<td class=\"worth\">$6,4 B</td>"
##  [68] "\t\t<td class=\"worth\">$6 B</td>"
##  [69] "\t\t<td class=\"worth\">$6 B</td>"
##  [70] "\t\t<td class=\"worth\">$5,9 B</td>"
##  [71] "\t\t<td class=\"worth\">$5,8 B</td>"
##  [72] "\t\t<td class=\"worth\">$5,8 B</td>"
##  [73] "\t\t<td class=\"worth\">$5,7 B</td>"
##  [74] "\t\t<td class=\"worth\">$5,6 B</td>"
##  [75] "\t\t<td class=\"worth\">$5,6 B</td>"
##  [76] "\t\t<td class=\"worth\">$5,6 B</td>"
##  [77] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [78] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [79] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [80] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [81] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [82] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [83] "\t\t<td class=\"worth\">$5,5 B</td>"
##  [84] "\t\t<td class=\"worth\">$5,3 B</td>"
##  [85] "\t\t<td class=\"worth\">$5,2 B</td>"
##  [86] "\t\t<td class=\"worth\">$5,2 B</td>"
##  [87] "\t\t<td class=\"worth\">$5,2 B</td>"
##  [88] "\t\t<td class=\"worth\">$5,1 B</td>"
##  [89] "\t\t<td class=\"worth\">$5,1 B</td>"
##  [90] "\t\t<td class=\"worth\">$5 B</td>"
##  [91] "\t\t<td class=\"worth\">$5 B</td>"
##  [92] "\t\t<td class=\"worth\">$5 B</td>"
##  [93] "\t\t<td class=\"worth\">$4,9 B</td>"
##  [94] "\t\t<td class=\"worth\">$4,8 B</td>"
##  [95] "\t\t<td class=\"worth\">$4,7 B</td>"
##  [96] "\t\t<td class=\"worth\">$4,7 B</td>"
##  [97] "\t\t<td class=\"worth\">$4,7 B</td>"
##  [98] "\t\t<td class=\"worth\">$4,6 B</td>"
##  [99] "\t\t<td class=\"worth\">$4,6 B</td>"
## [100] "\t\t<td class=\"worth\">$4,6 B</td>"
```

4. Напишите код, использовав регулярное выражение из п. 3, и функции `regexp` и `regmatches`, чтобы извлечь все данные о доходе. Проверьте следующее:
5. Должно быть ровно сто значений.

```
worth.value <- regmatches(html, regexpr("\\$[\\d,]* B", html, perl = TRUE))
worth.value
```

```
##   [1] "$72 B"   "$58,5 B" "$41 B"   "$36 B"   "$36 B"   "$35,4 B" "$33,8 B"
##   [8] "$33,5 B" "$33,3 B" "$31 B"   "$28,5 B" "$27,2 B" "$24,9 B" "$24,4 B"
##  [15] "$20,5 B" "$20,5 B" "$20,5 B" "$20,3 B" "$20 B"   "$19 B"   "$18 B"
##  [22] "$17,8 B" "$17,2 B" "$16,3 B" "$15,9 B" "$15,8 B" "$14 B"   "$14 B"
##  [29] "$13,5 B" "$13,4 B" "$12,9 B" "$12,5 B" "$12,4 B" "$12 B"   "$11,7 B"
##  [36] "$11,4 B" "$11,4 B" "$10,3 B" "$10,2 B" "$10 B"   "$10 B"   "$9,8 B"
##  [43] "$9,4 B"  "$9,3 B"  "$9 B"    "$8,9 B"  "$8,5 B"  "$8,5 B"  "$8,3 B"
##  [50] "$8,3 B"  "$8,3 B"  "$8,2 B"  "$7,9 B"  "$7,7 B"  "$7,7 B"  "$7,6 B"
##  [57] "$7,5 B"  "$7,2 B"  "$6,9 B"  "$6,8 B"  "$6,7 B"  "$6,7 B"  "$6,7 B"
##  [64] "$6,7 B"  "$6,4 B"  "$6,4 B"  "$6,4 B"  "$6 B"    "$6 B"    "$5,9 B"
##  [71] "$5,8 B"  "$5,8 B"  "$5,7 B"  "$5,6 B"  "$5,6 B"  "$5,6 B"  "$5,5 B"
##  [78] "$5,5 B"  "$5,5 B"  "$5,5 B"  "$5,5 B"  "$5,5 B"  "$5,5 B"  "$5,3 B"
##  [85] "$5,2 B"  "$5,2 B"  "$5,2 B"  "$5,1 B"  "$5,1 B"  "$5 B"    "$5 B"
##  [92] "$5 B"    "$4,9 B"  "$4,8 B"  "$4,7 B"  "$4,7 B"  "$4,7 B"  "$4,6 B"
##  [99] "$4,6 B"  "$4,6 B"
```

```
length(worth.value)
```

```
## [1] 100
```

2. Самый большой доход должен быть доход Билла Гейтса

```
#вычищаем мусор
worth.value <- gsub(" B","",worth.value)
worth.value <- gsub("\\$","",worth.value)
worth.value <- gsub(",",".",worth.value)
worth.value <- as.numeric(worth.value)
max(worth.value)
```

```
## [1] 72
```

3. Такой доход должен быть в списке один раз.

```
length(worth.value[worth.value == max(worth.value)])
```

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

4. В всписке должна быть цифра, которую мы запомнили для Ларри Эллисона.

```
worth.value[3]
```

```
## [1] 41
```

5. Должно быть как минимум два значения, встречающихся несколько раз

```
sort(worth.value[duplicated(worth.value)]) #wtf 36
```

```
##  [1]  4.6  4.6  4.7  4.7  5.0  5.0  5.1  5.2  5.2  5.5  5.5  5.5  5.5  5.5
## [15]  5.5  5.6  5.6  5.8  6.0  6.4  6.4  6.7  6.7  6.7  7.7  8.3  8.3  8.5
## [29] 10.0 11.4 14.0 20.5 20.5 36.0
```

Задание 2

5. В данных доход представлен в формате **“$42 B”**, что означает **42 × 10^9**. Преобразуйте этот формат в числовой и сохраните в вектор *worths*. Удостоверьтесь в следующем:

```
worths <- worth.value * 10^9;
worths
```

```
##   [1] 7.20e+10 5.85e+10 4.10e+10 3.60e+10 3.60e+10 3.54e+10 3.38e+10
##   [8] 3.35e+10 3.33e+10 3.10e+10 2.85e+10 2.72e+10 2.49e+10 2.44e+10
##  [15] 2.05e+10 2.05e+10 2.05e+10 2.03e+10 2.00e+10 1.90e+10 1.80e+10
##  [22] 1.78e+10 1.72e+10 1.63e+10 1.59e+10 1.58e+10 1.40e+10 1.40e+10
##  [29] 1.35e+10 1.34e+10 1.29e+10 1.25e+10 1.24e+10 1.20e+10 1.17e+10
##  [36] 1.14e+10 1.14e+10 1.03e+10 1.02e+10 1.00e+10 1.00e+10 9.80e+09
##  [43] 9.40e+09 9.30e+09 9.00e+09 8.90e+09 8.50e+09 8.50e+09 8.30e+09
##  [50] 8.30e+09 8.30e+09 8.20e+09 7.90e+09 7.70e+09 7.70e+09 7.60e+09
##  [57] 7.50e+09 7.20e+09 6.90e+09 6.80e+09 6.70e+09 6.70e+09 6.70e+09
##  [64] 6.70e+09 6.40e+09 6.40e+09 6.40e+09 6.00e+09 6.00e+09 5.90e+09
##  [71] 5.80e+09 5.80e+09 5.70e+09 5.60e+09 5.60e+09 5.60e+09 5.50e+09
##  [78] 5.50e+09 5.50e+09 5.50e+09 5.50e+09 5.50e+09 5.50e+09 5.30e+09
##  [85] 5.20e+09 5.20e+09 5.20e+09 5.10e+09 5.10e+09 5.00e+09 5.00e+09
##  [92] 5.00e+09 4.90e+09 4.80e+09 4.70e+09 4.70e+09 4.70e+09 4.60e+09
##  [99] 4.60e+09 4.60e+09
```

1. *worths* является вектором и в нём сто занчений типа *double*.

```
is.vector(worths)
```

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

```
is.double(worths)
```

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

```
length(worths)
```

```
## [1] 100
```

2. Все элементы вектора *worths* больше 1 миллиарда.

```
length(worths[worths > 10^9])
```

```
## [1] 100
```

3. Самое большое число это доход Билла Гейтса.

```
max(worths)
```

```
## [1] 7.2e+10
```

6. Используйте вектор *worths* , чтобы выяснить следующее:
7. Какова медиана ста этих записей?

```
median(worths)
```

```
## [1] 8.3e+09
```

2. Средний доход?

```
mean(worths)
```

```
## [1] 1.293e+10
```

3. Как много людей из этого списка имеют доход больше 5млрд., 10, 25?

```
length(worths[worths > 5*10^9])
```

```
## [1] 89
```

```
length(worths[worths > 10*10^9])
```

```
## [1] 39
```

```
length(worths[worths > 25*10^9])
```

```
## [1] 12
```

4. Какой их общий доход?

```
sum(worths)
```

```
## [1] 1.293e+12
```

2. Какую долю от общего дохода, составляет пятёрка самых богатых.

```
sum(worths[1:5])/sum(worths) * 100 #%
```

```
## [1] 18.83217
```

3. Какую долю от общего дохода, составляют 20 самых богатых.

```
sum(worths[1:20])/sum(worths) * 100 #%
```

```
## [1] 49.21114
```

4. В данных федерального резерва США (https://www.federalreserve.gov/releases/z1/current/z1.pdf) найдите показатель дохода всех домохозяйств (Household net worth) в соответвующем году, какую долю общего дохода составляют 100 богатейших людей.

```
household.net.worth <- 78.536 * 10^9
household.net.worth
```

```
## [1] 7.8536e+10
```

```
sum(worths)
```

```
## [1] 1.293e+12
```

```
#что-то пошло не так
sum(worths) / household.net.worth
```

```
## [1] 16.46379
```