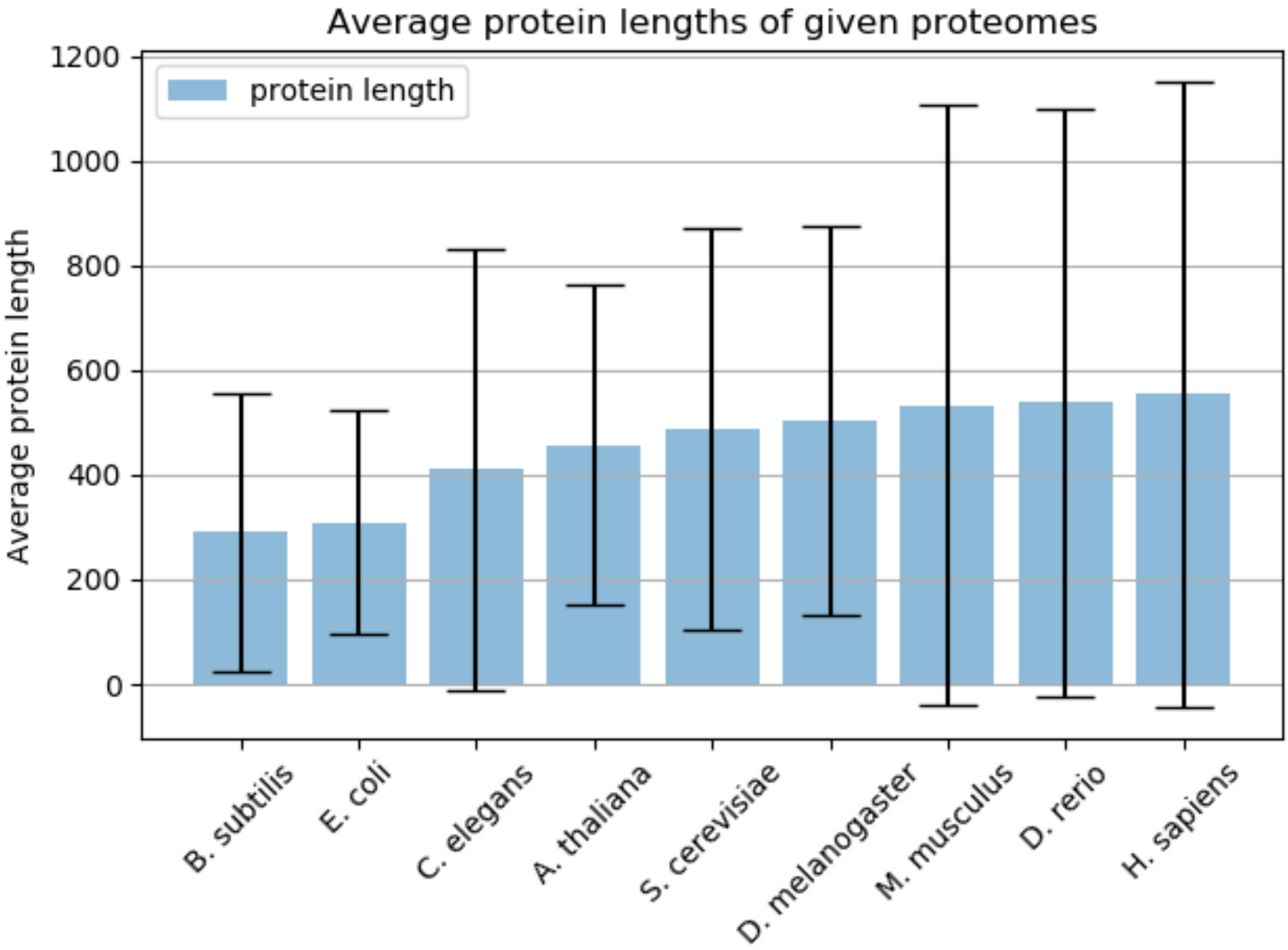
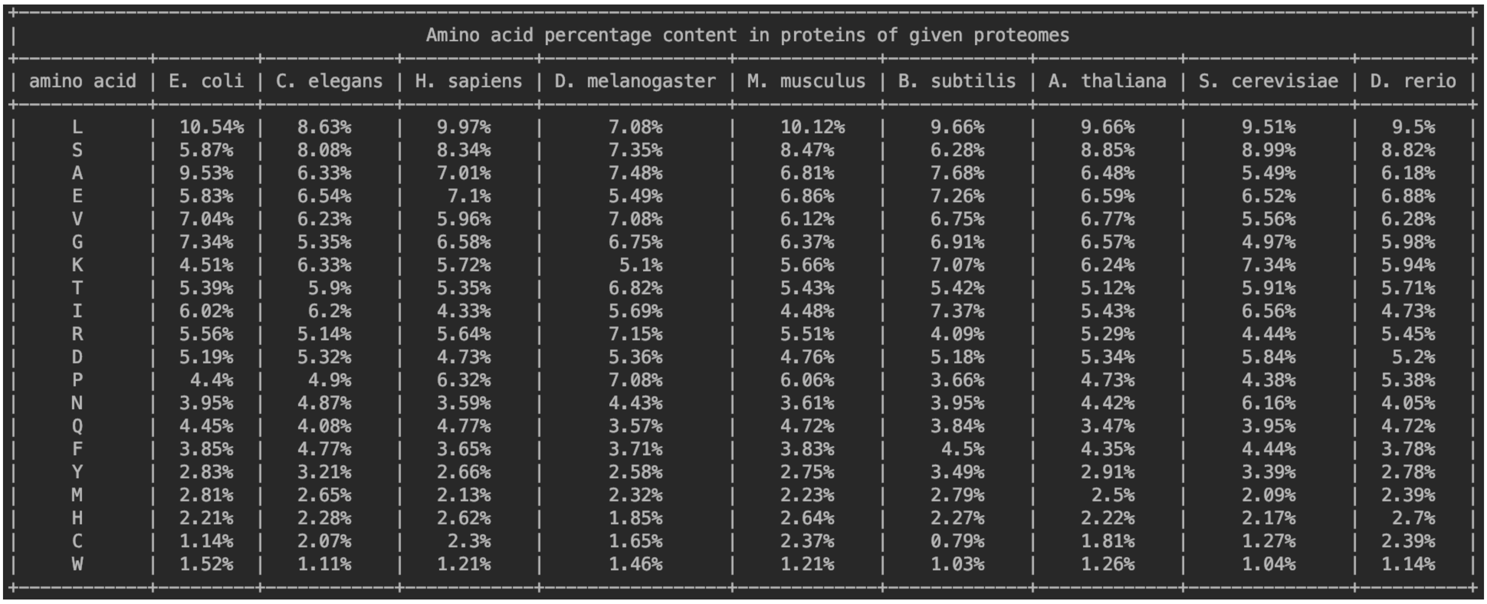
Data analysis and visualisation
Homework I report
Piotr Rutkowski, MIMUW

(a)





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|                                      Amino acid percentage content in proteins of given proteomes                                 |
+------------+---------+------------+------------+-----------------+-------------+-------------+-------------+---------------+-----------+
| amino acid | E. coli | C. elegans | H. sapiens | D. melanogaster | M. musculus | B. subtilis | A. thaliana | S. cerevisiae | D. rerio |
+------------+---------+------------+------------+-----------------+-------------+-------------+-------------+---------------+-----------+
|     L      |  10.54% |   8.63%    |   9.97%    |      7.08%      |    10.12%   |    9.66%    |    9.66%    |     9.51%     |    9.5%   |
|     S      |  5.87%  |   8.08%    |   8.34%    |      7.35%      |    8.47%    |    6.28%    |    8.85%    |     8.99%     |   8.82%   |
|     A      |  9.53%  |   6.33%    |   7.01%    |      7.48%      |    6.81%    |    7.68%    |    6.48%    |     5.49%     |   6.18%   |
|     E      |  5.83%  |   6.54%    |    7.1%    |      5.49%      |    6.86%    |    7.26%    |    6.59%    |     6.52%     |   6.88%   |
|     V      |  7.04%  |   6.23%    |   5.96%    |      7.08%      |    6.12%    |    6.75%    |    6.77%    |     5.56%     |   6.28%   |
|     G      |  7.34%  |   5.35%    |   6.58%    |      6.75%      |    6.37%    |    6.91%    |    6.57%    |     4.97%     |   5.98%   |
|     K      |  4.51%  |   6.33%    |   5.72%    |       5.1%      |    5.66%    |    7.07%    |    6.24%    |     7.34%     |   5.94%   |
|     T      |  5.39%  |    5.9%    |   5.35%    |      6.82%      |    5.43%    |    5.42%    |    5.12%    |     5.91%     |   5.71%   |
|     I      |  6.02%  |    6.2%    |   4.33%    |      5.69%      |    4.48%    |    7.37%    |    5.43%    |     6.56%     |   4.73%   |
|     R      |  5.56%  |   5.14%    |   5.64%    |      7.15%      |    5.51%    |    4.09%    |    5.29%    |     4.44%     |   5.45%   |
|     D      |  5.19%  |   5.32%    |   4.73%    |      5.36%      |    4.76%    |    5.18%    |    5.34%    |     5.84%     |    5.2%   |
|     P      |   4.4%  |    4.9%    |   6.32%    |      7.08%      |    6.06%    |    3.66%    |    4.73%    |     4.38%     |   5.38%   |
|     N      |  3.95%  |   4.87%    |   3.59%    |      4.43%      |    3.61%    |    3.95%    |    4.42%    |     6.16%     |   4.05%   |
|     Q      |  4.45%  |   4.08%    |   4.77%    |      3.57%      |    4.72%    |    3.84%    |    3.47%    |     3.95%     |   4.72%   |
|     F      |  3.85%  |   4.77%    |   3.65%    |      3.71%      |    3.83%    |     4.5%    |    4.35%    |     4.44%     |   3.78%   |
|     Y      |  2.83%  |   3.21%    |   2.66%    |      2.58%      |    2.75%    |    3.49%    |    2.91%    |     3.39%     |   2.78%   |
|     M      |  2.81%  |   2.65%    |   2.13%    |      2.32%      |    2.23%    |    2.79%    |     2.5%    |     2.09%     |   2.39%   |
|     H      |  2.21%  |   2.28%    |   2.62%    |      1.85%      |    2.64%    |    2.27%    |    2.22%    |     2.17%     |    2.7%   |
|     C      |  1.14%  |   2.07%    |    2.3%    |      1.65%      |    2.37%    |    0.79%    |    1.81%    |     1.27%     |   2.39%   |
|     W      |  1.52%  |   1.11%    |   1.21%    |      1.46%      |    1.21%    |    1.03%    |    1.26%    |     1.04%     |   1.14%   |
+------------+---------+------------+------------+-----------------+-------------+-------------+-------------+---------------+-----------+
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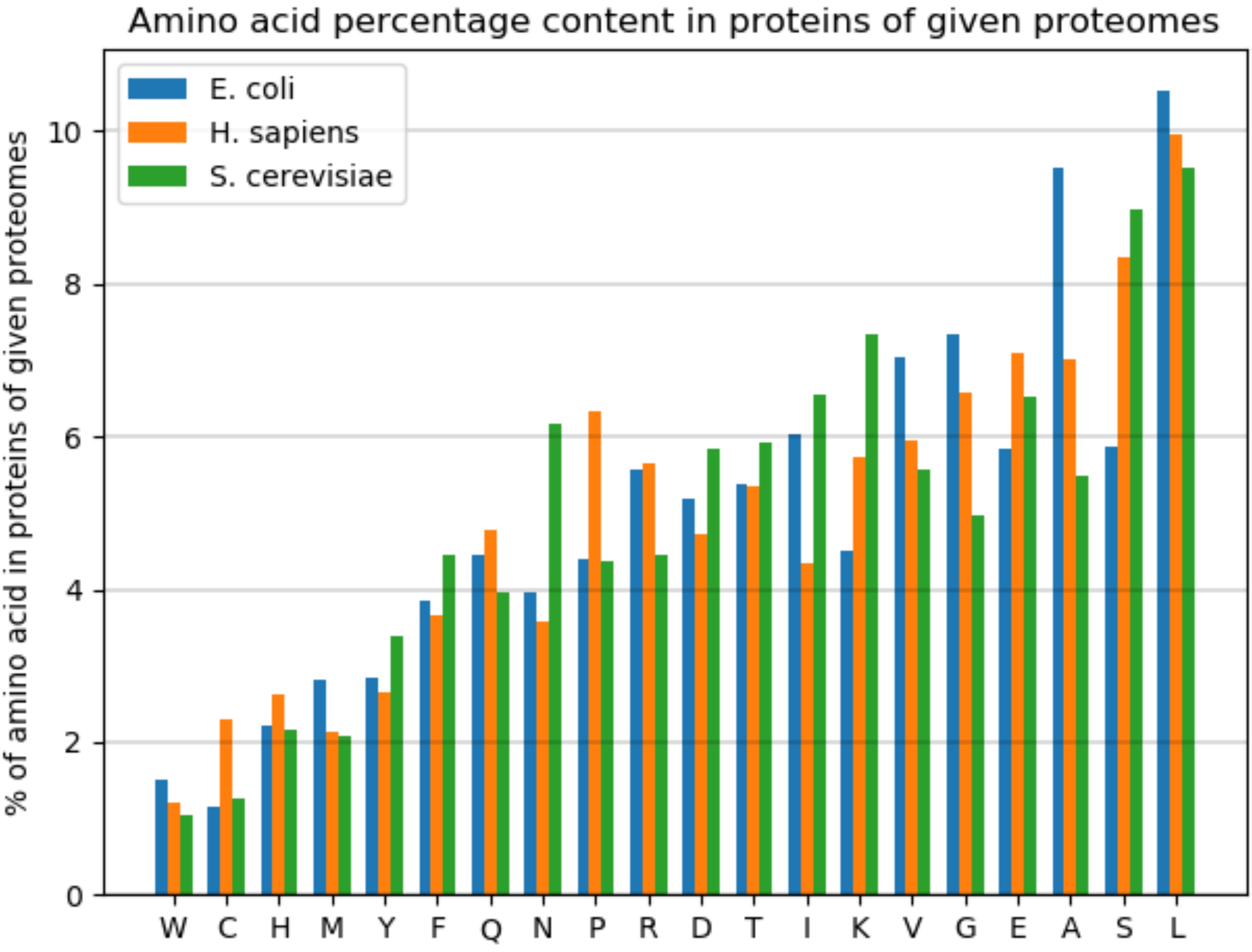
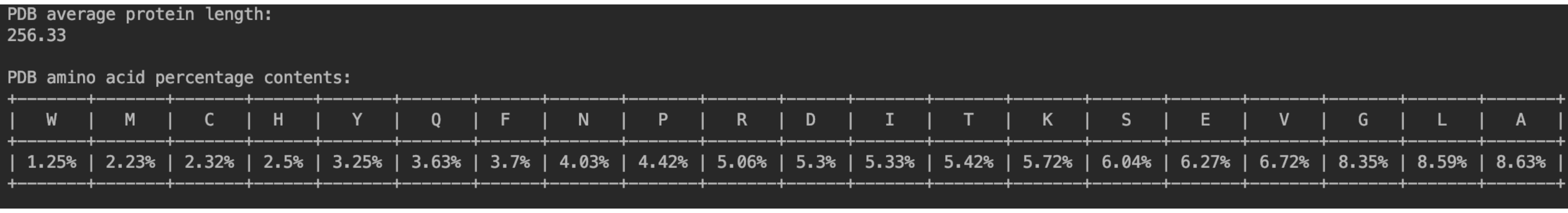


(b)

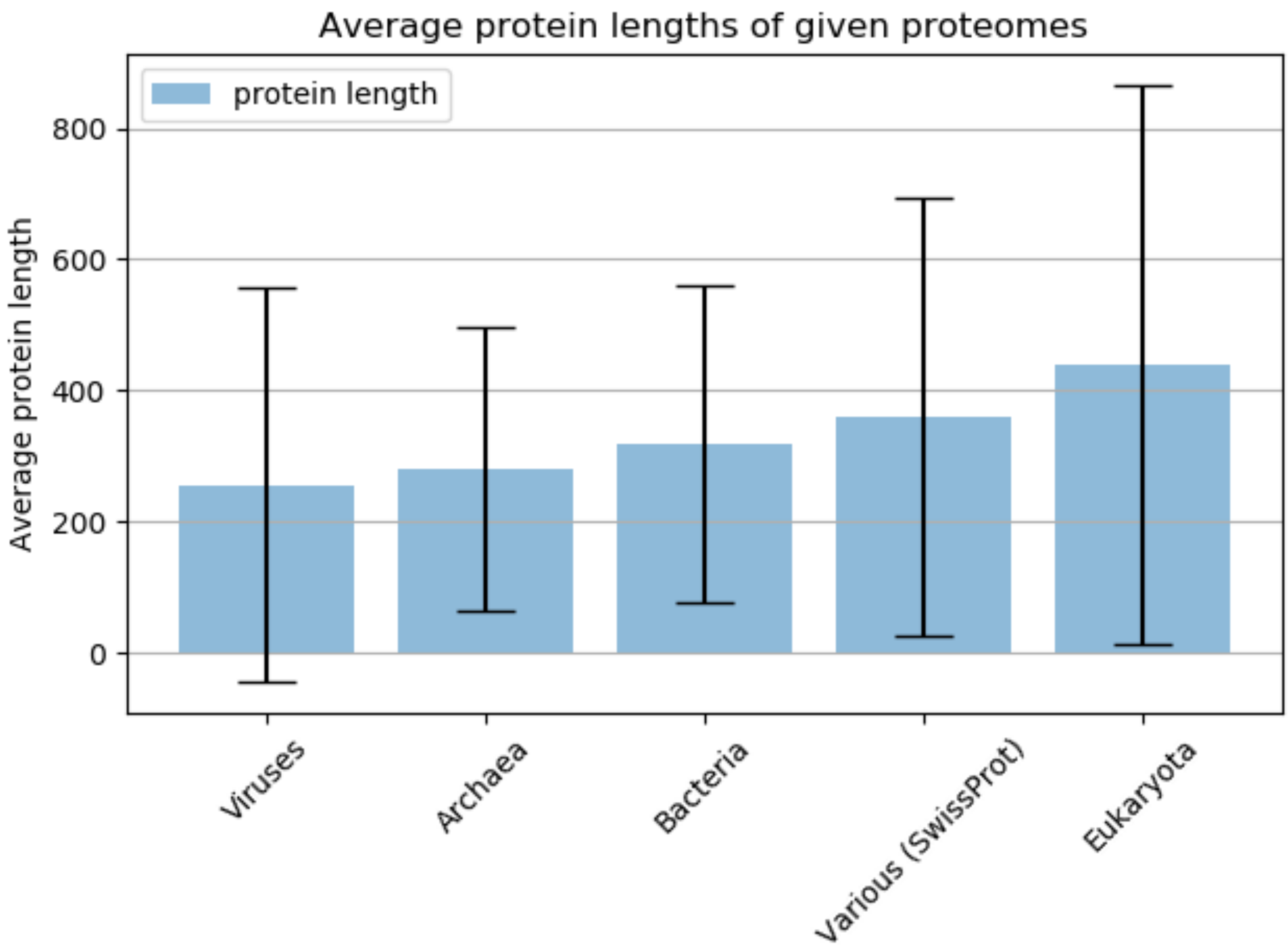


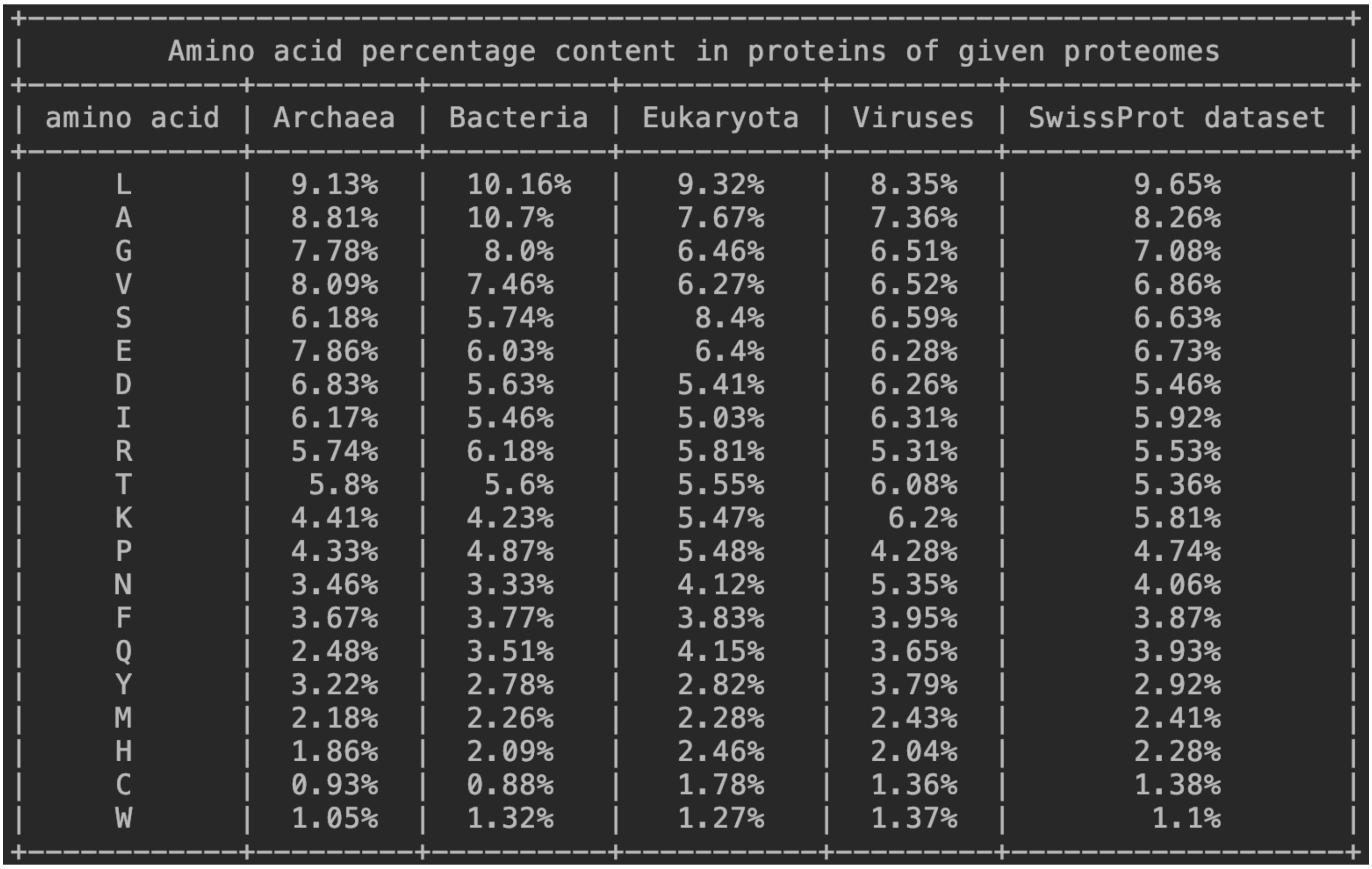
```
PDB average protein length:
256.33

PDB amino acid percentage contents:
+-------+-------+-------+------+-------+-------+------+-------+-------+-------+------+-------+-------+-------+-------+-------+-------+-------+-------+-------+
|   W   |   M   |   C   |  H   |   Y   |   Q   |  F   |   N   |   P   |   R   |  D   |   I   |   T   |   K   |   S   |   E   |   V   |   G   |   L   |   A   |
+-------+-------+-------+------+-------+-------+------+-------+-------+-------+------+-------+-------+-------+-------+-------+-------+-------+-------+-------+
| 1.25% | 2.23% | 2.32% | 2.5% | 3.25% | 3.63% | 3.7% | 4.03% | 4.42% | 5.06% | 5.3% | 5.33% | 5.42% | 5.72% | 6.04% | 6.27% | 6.72% | 8.35% | 8.59% | 8.63% |
+-------+-------+-------+------+-------+-------+------+-------+-------+-------+------+-------+-------+-------+-------+-------+-------+-------+-------+-------+
```

I don’t know why there is a difference.

(c)





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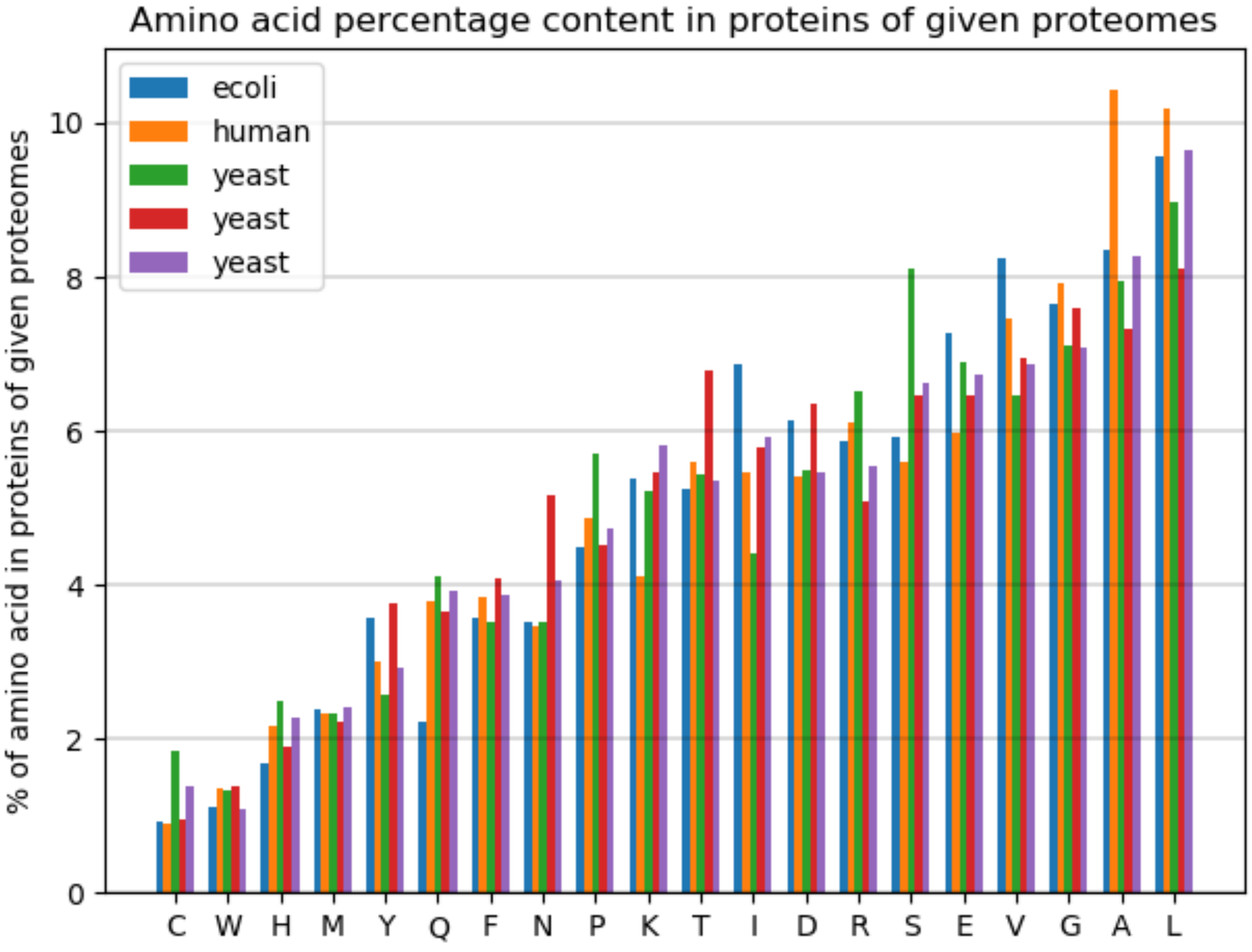
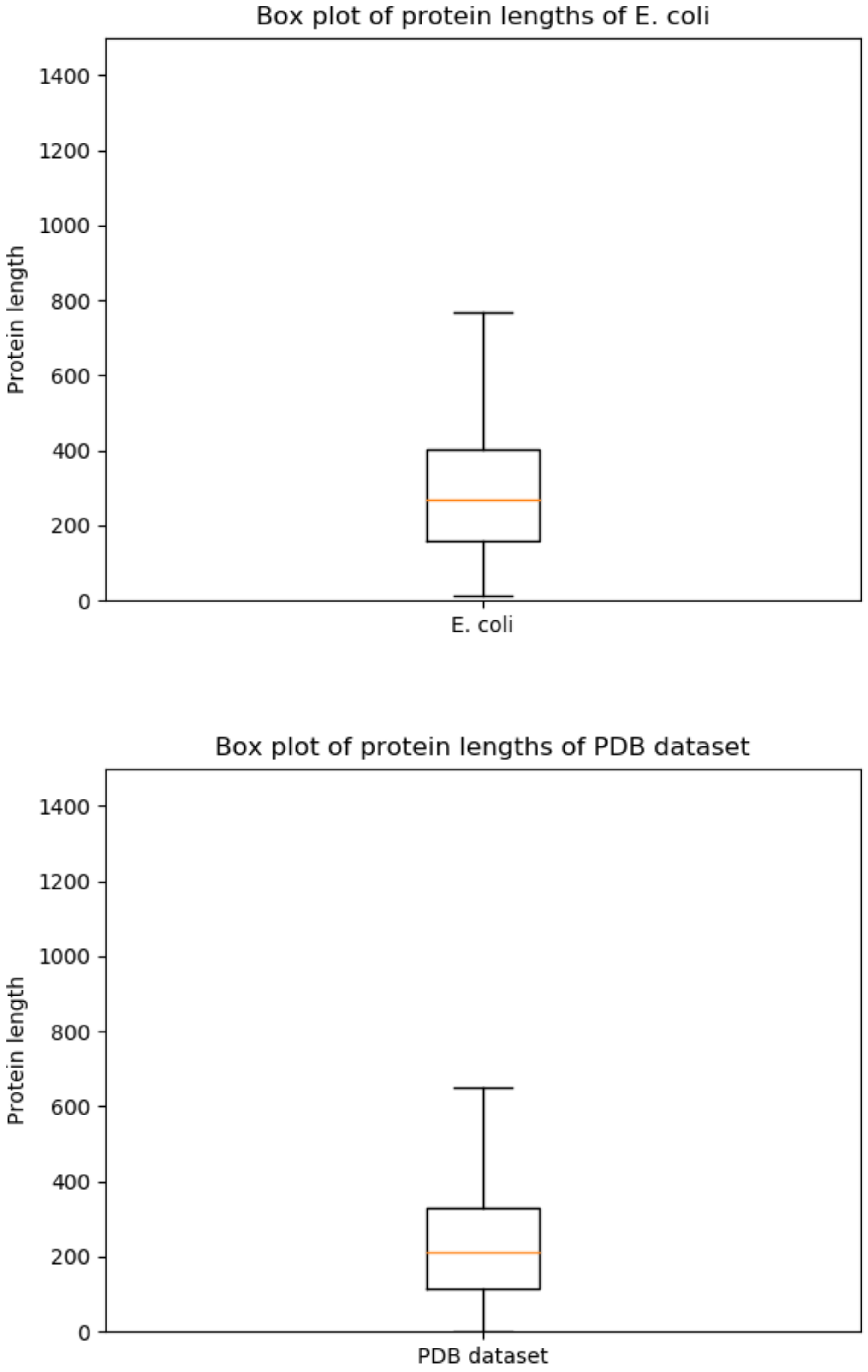
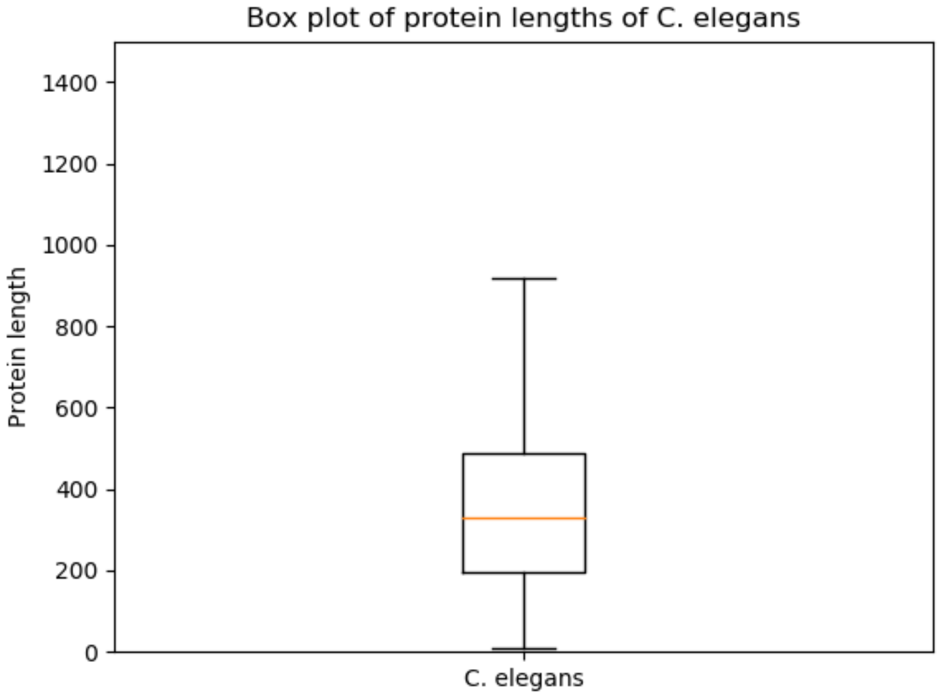
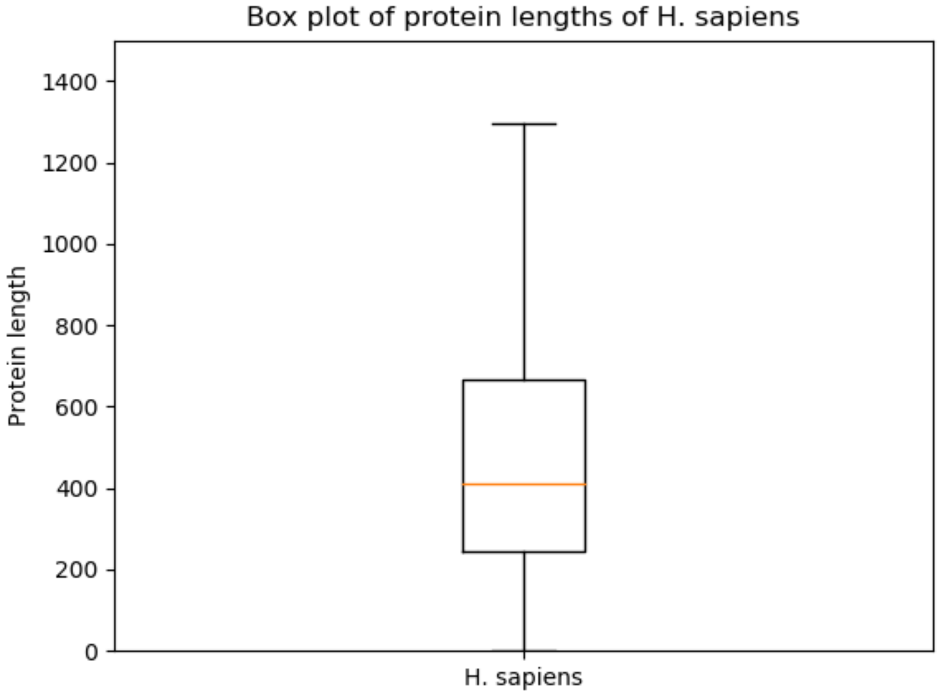
+---------------------------------------------------------------------------+
|       Amino acid percentage content in proteins of given proteomes        |
+------------+---------+----------+-----------+---------+-------------------+
| amino acid | Archaea | Bacteria | Eukaryota | Viruses | SwissProt dataset |
+------------+---------+----------+-----------+---------+-------------------+
|      L     |  9.13%  |  10.16%  |   9.32%   |  8.35%  |       9.65%       |
|      A     |  8.81%  |  10.7%   |   7.67%   |  7.36%  |       8.26%       |
|      G     |  7.78%  |   8.0%   |   6.46%   |  6.51%  |       7.08%       |
|      V     |  8.09%  |  7.46%   |   6.27%   |  6.52%  |       6.86%       |
|      S     |  6.18%  |  5.74%   |    8.4%   |  6.59%  |       6.63%       |
|      E     |  7.86%  |  6.03%   |    6.4%   |  6.28%  |       6.73%       |
|      D     |  6.83%  |  5.63%   |   5.41%   |  6.26%  |       5.46%       |
|      I     |  6.17%  |  5.46%   |   5.03%   |  6.31%  |       5.92%       |
|      R     |  5.74%  |  6.18%   |   5.81%   |  5.31%  |       5.53%       |
|      T     |   5.8%  |   5.6%   |   5.55%   |  6.08%  |       5.36%       |
|      K     |  4.41%  |  4.23%   |   5.47%   |   6.2%  |       5.81%       |
|      P     |  4.33%  |  4.87%   |   5.48%   |  4.28%  |       4.74%       |
|      N     |  3.46%  |  3.33%   |   4.12%   |  5.35%  |       4.06%       |
|      F     |  3.67%  |  3.77%   |   3.83%   |  3.95%  |       3.87%       |
|      Q     |  2.48%  |  3.51%   |   4.15%   |  3.65%  |       3.93%       |
|      Y     |  3.22%  |  2.78%   |   2.82%   |  3.79%  |       2.92%       |
|      M     |  2.18%  |  2.26%   |   2.28%   |  2.43%  |       2.41%       |
|      H     |  1.86%  |  2.09%   |   2.46%   |  2.04%  |       2.28%       |
|      C     |  0.93%  |  0.88%   |   1.78%   |  1.36%  |       1.38%       |
|      W     |  1.05%  |  1.32%   |   1.27%   |  1.37%  |        1.1%       |
+------------+---------+----------+-----------+---------+-------------------+
```

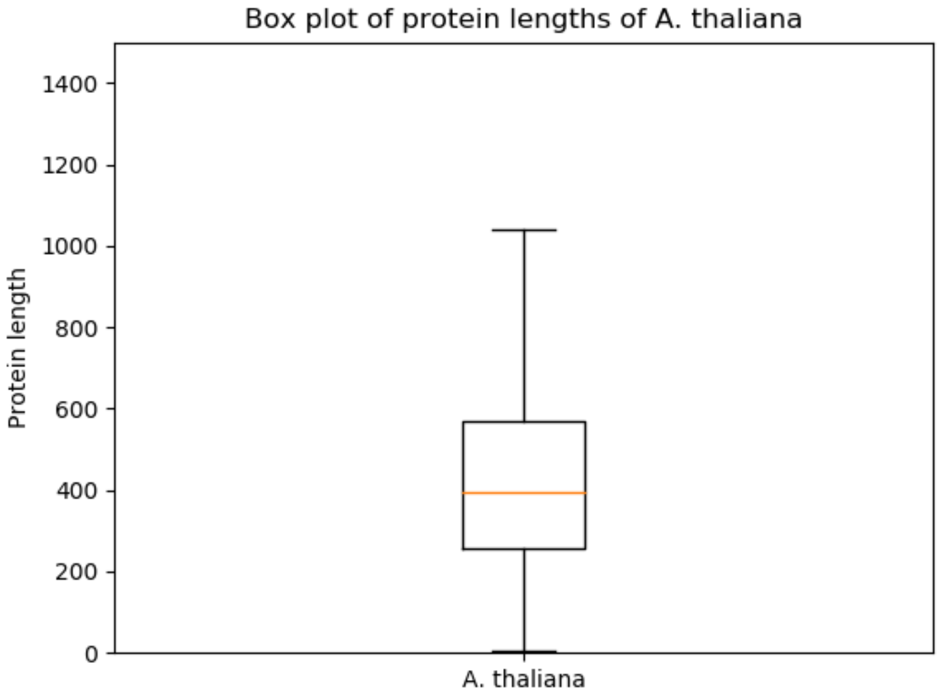

Amino acid percentage content in proteins of given proteomes
% of amino acid in proteins of given proteomes
ecoli
human
yeast
yeast
yeast
0
2
4
6
8
10
C
W
H
M
Y
Q
F
N
P
K
T
I
D
R
S
E
V
G
A
L

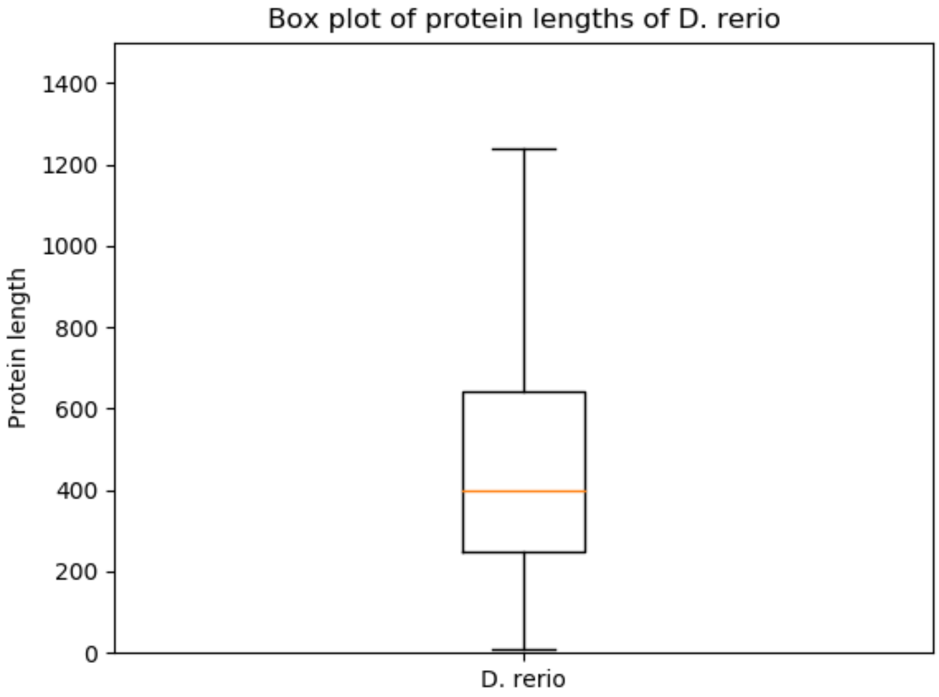
(d)

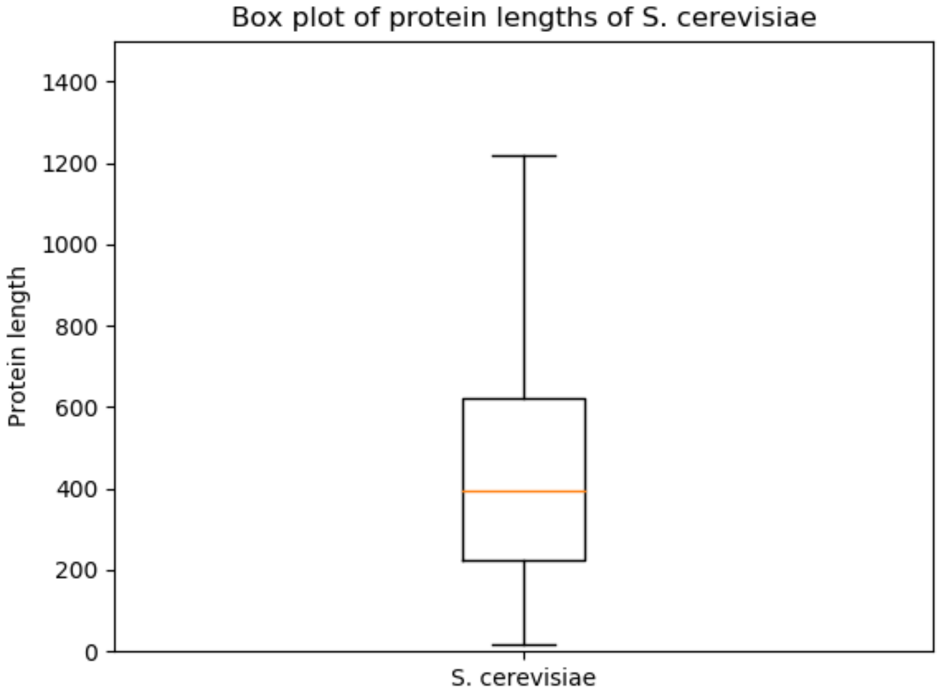

Box plot of protein lengths of E. coli
Protein length
0
200
400
600
800
1000
1200
1400
E. coli
Box plot of protein lengths of PDB dataset
Protein length
0
200
400
600
800
1000
1200
1400
PDB dataset


Box plot of protein lengths of C. elegans
Protein length
1400
1200
1000
800
600
400
200
0
C. elegans

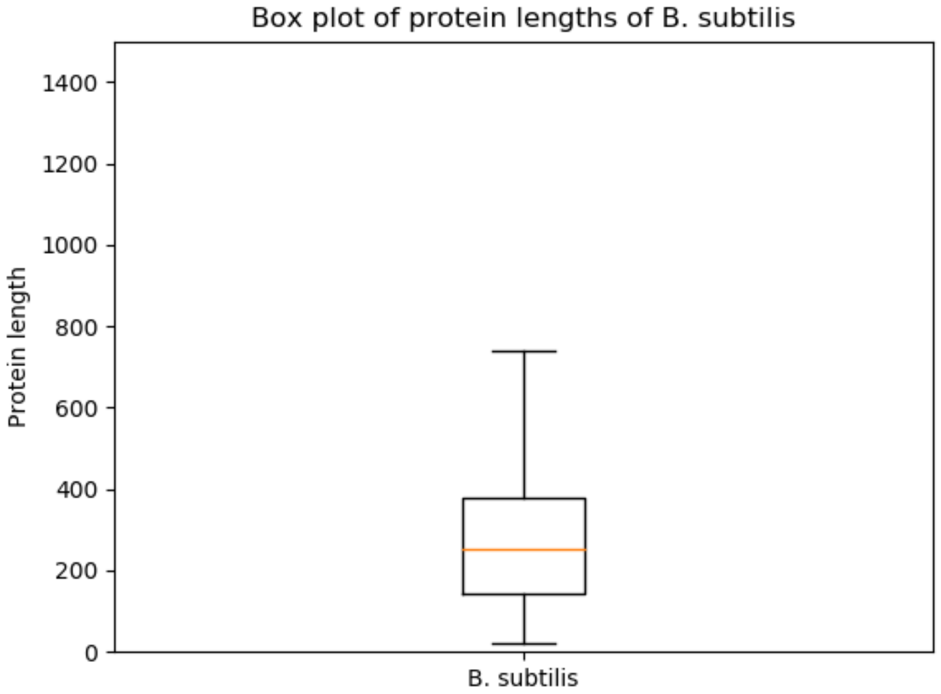

Box plot of protein lengths of H. sapiens
Protein length
1400
1200
1000
800
600
400
200
0
H. sapiens


Box plot of protein lengths of A. thaliana
Protein length
1400
1200
1000
800
600
400
200
0
A. thaliana

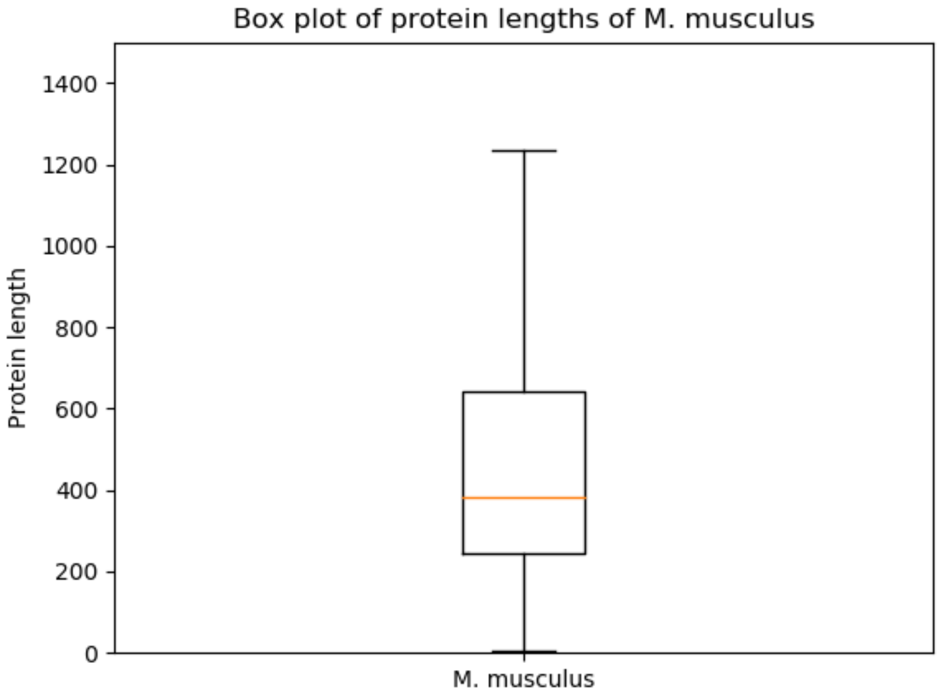

Box plot of protein lengths of D. rerio
Protein length
1400
1200
1000
800
600
400
200
0
D. rerio

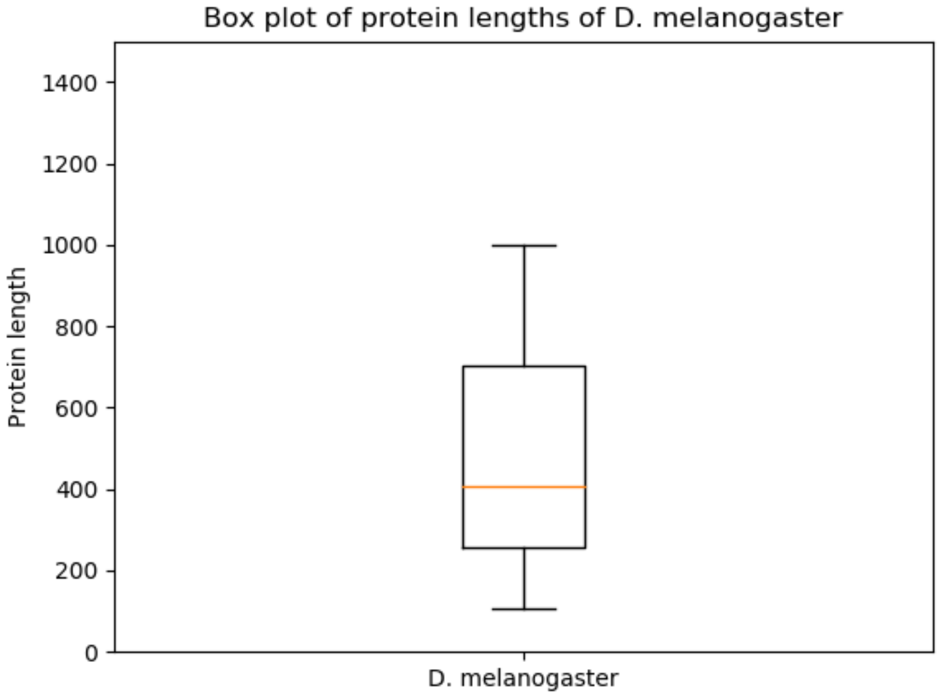


Box plot of protein lengths of S. cerevisiae



Box plot of protein lengths of B. subtilis

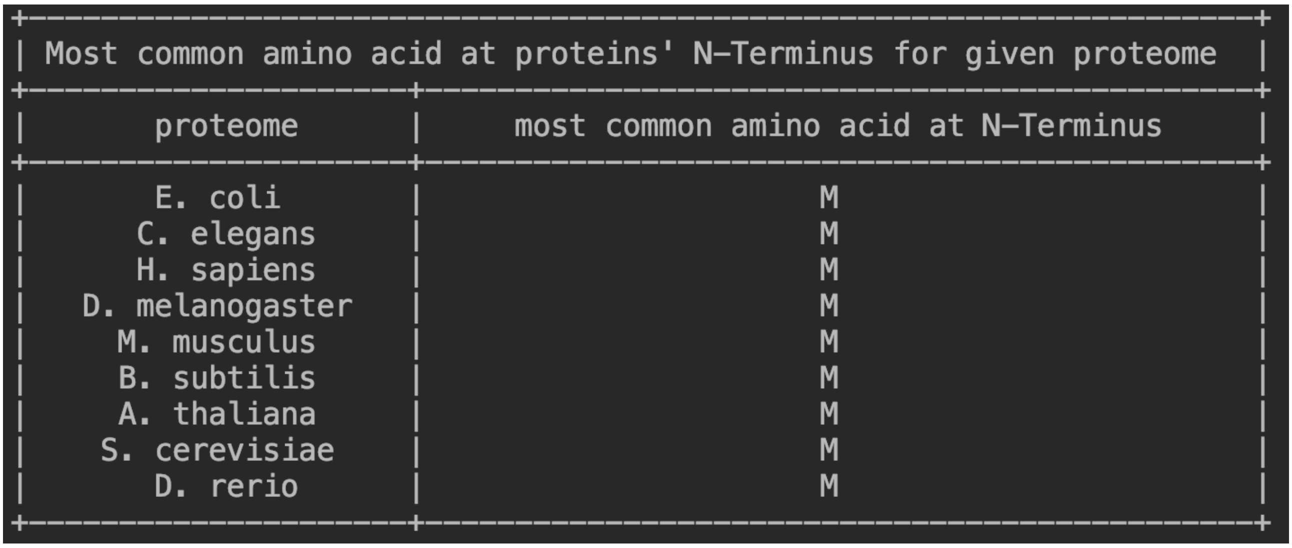

Box plot of protein lengths of M. musculus
Protein length
0
200
400
600
800
1000
1200
1400
M. musculus


Box plot of protein lengths of D. melanogaster
Protein length
0
200
400
600
800
1000
1200
1400
D. melanogaster

Median vs mean

These are both values that numerically represent a set of numbers. Mean tells as what is the average value of our set, whereas median shows us where our data is split in half (50th percentile). Which value should be used is hugely dependent on the data and problem we have. The upside of mean is that it’s easier to implement. But it’s necessary to note that one is NOT better than the other one. If we want to achieve information on how data is split, we should use median. On the other hand, unless we want to know how data is split, we should probably use mean.

(e)



```
+----------------------------------------------------------------------+
| Most common amino acid at proteins' N-Terminus for given proteome   |
+---------------------+------------------------------------------------+
|       proteome      |      most common amino acid at N-Terminus      |
+---------------------+------------------------------------------------+
|       E. coli       |                       M                        |
|      C. elegans     |                       M                        |
|      H. sapiens     |                       M                        |
|   D. melanogaster   |                       M                        |
|     M. musculus     |                       M                        |
|     B. subtilis     |                       M                        |
|     A. thaliana     |                       M                        |
|    S. cerevisiae    |                       M                        |
|       D. rerio      |                       M                        |
+---------------------+------------------------------------------------+
```

Methionine (M) is the most frequent amino acid at N-termini. Moreover, it’s the most frequent one for all 9 organisms. That’s because it is used to initiate protein synthesis for essentially all proteins.