ZUBY

```python
1  data = pd.read_csv("data-zuby.txt", delimiter=" ")
2  s_1, s_2 = data["zuby_pomlau"], data["zuby_sok"]
3  n_1, n_2 = s_1.size, s_2.size
4  # data.boxplot()
5
6  # alpha
7  a=0.05
8
9  # std err
10 se_p = math.sqrt(s_1.var() + (s_2.var)()) / math.sqrt(n_2)
11
12 # mu
13 mu = (s_1.mean()- s_2.mean())
14
15 # t stat
16 t_stat = mu / se_p
17
18 # df
19 df = n_1 -1 + n_2 - 1 # same variance
20 df = se_p**4 / (1/(n_1 - 1) * (s_1.var()/n_1)**2 +  1/(n_1 - 1) * (s_2.var()/n
21
22
23 # p values for t_stat
24 pval_two_sided = stats.t.sf(abs(t_stat), df)*2  # Prob(abs(t)>t_stat)
25 pval_one_sided = stats.t.sf(abs(t_stat), df)    # Prob(abs(t)>t_stat) / 2
26
27
28 # t critic for df, alpha
29 t_crit_two_sided = stats.t.ppf(q=1-a/2, df=df) # a/2
30 t_crit_one_sided = stats.t.ppf(q=1-a, df=df)
31
32 # iterval two sided
33 interval_L = mu - t_crit_two_sided*se_p
34 interval_R = mu + t_crit_two_sided*se_p
```

TWO-SAMPLE TEST (TWO-TAILED)

H0: mu(pomalu varene) == mu(rychle varene)

H1: mu(pomalu varene) != mu(rychle varene)

```python
In [125]:   1  # TEST BY VALUE OF STATISTICS
            2  if abs(t_stat) > t_crit_two_sided:
            3      print("|t_stat| >= t_crit : {} > {}".format(t_stat, t_crit_two_sided))
            4      print("\t REJECTING H0 in favor of H1")
            5      print("\t H1: mu(pomalu varene)  != mu(rychle varene)  ")
            6      print("")
            7
            8  else:
            9      print("|t_stat| < t_crit : {} <= {}".format(t_stat, t_crit_two_sided))
           10      print("\t Failed to reject H0")
           11      print("\t H0: mu(rychle varene) ==  mu(pomalu varene) ")
           12      print("")
           13
           14
           15  # TEST BY P VALUE
           16  if pval_two_sided < a:
           17      print("p_val < alpha : {} < {}".format(pval_two_sided, a))
           18      print("\t REJECTING H0 in favor of H1")
           19      print("\t H1: mu(pomalu varene)  > mu(rychle varene)")
           20      print("")
           21
           22  else:
           23      print("p_val >= alpha : {} >= {}".format(pval_two_sided, a))
           24      print("\t Failed to reject H0")
           25      print("\t H0: mu(rychle varene) ==  mu(pomalu varene) ")
           26      print("")
           27
           28
           29  # INTERVAL
           30  interval_L = mu - t_crit_two_sided*se_p
           31  interval_R = mu + t_crit_two_sided*se_p
           32  print("(1-{})% conf. interval ({},{})".format(a, interval_L, interval_R))
```

```
|t_stat| < t_crit : 2.019354722091951 <= 2.2042005991260605
        Failed to reject H0
        H0: mu(rychle varene) ==  mu(pomalu varene)

p_val >= alpha : 0.06879844307365293 >= 0.05
        Failed to reject H0
        H0: mu(rychle varene) ==  mu(pomalu varene)

(1-0.05)% conf. interval (-0.1064118798452327,2.4314118798452284)
```

TWO-SAMPLE (ONE-TAILED TEST)

H0: mu(rychle varene) >= mu(pomalu varene)

H1: mu(pomalu varene) > mu(rychle varene)

```
In [136]:   1   # TEST BY VALUE OF STATISTICS
            2   if t_stat < t_crit_one_sided:
            3       print("t_stat < t_crit : {} < {}".format(t_stat, t_crit_one_sided))
            4       print("\t Failed to reject H0")
            5       print("\t H0: mu(rychle varene) >=  mu(pomalu varene) ")
            6       print("")
            7
            8   else:
            9       print("t_stat >= t_crit : {} >= {}".format(t_stat, t_crit_one_sided))
           10       print("\t REJECTING H0 in favor of H1")
           11       print("\t H1: mu(pomalu varene) > mu(rychle varene)  ")
           12       print("")
           13
           14  # TEST BY P VALUE
           15  if pval_one_sided < a:
           16      print("p_val < alpha : {} < {}".format(pval_one_sided, a))
           17      print("\t REJECTING H0 in favor of H1")
           18      print("\t H1: mu(pomalu varene) > mu(rychle varene)  ")
           19      print("")
           20
           21  else:
           22      print("p_val >= alpha : {} >= {}".format(pval_one_sided, a))
           23      print("\t Failed to reject H0")
           24      print("\t H0: mu(rychle varene) >=  mu(pomalu varene) ")
           25      print("")
           26
           27  # INTERVAL
           28  interval_L = mu - t_crit_one_sided*se_p
           29  interval_R = mu + t_crit_one_sided*se_p
           30  print("(1-{})% conf. interval ({:.4f},+inf)".format(a, interval_L))
```

```
t_stat >= t_crit : 2.019354722091951 >= 1.7978520481089464
        REJECTING H0 in favor of H1
        H1: mu(pomalu varene) > mu(rychle varene)

p_val < alpha : 0.034399221536826466 < 0.05
        REJECTING H0 in favor of H1
        H1: mu(pomalu varene) > mu(rychle varene)

(1-0.05)% conf. interval (0.1275,+inf)
```

In [ ]:   1