# Data Science 02: Explorační analýza dat (Data Exploration)

In [1]:
```
# Instalace potřebných knihoven
#%pip install pandas
#%pip install numpy
#%pip install matplotlib
```

In [2]:
```
# Import potřebných knihoven
import pandas as pd
import numpy as np

import matplotlib as plt
from matplotlib import pyplot
```

In [3]:
```
# Soubor je načten a přiřazen do proměnné ‚df‘
other_path = "../../data/01_DataScience/clean_timelaps.csv"
df = pd.read_csv(other_path)
df.head()
```

Out[3]:

| | id | type_brick | time_start | time_verif | time_dest | time_end | time_start_sec | time_verif_sec | time_dest |
|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | CORNER | 13:52:18 | 13:52:24 | 13:52:41 | 13:52:59 | 49938 | 49944 | 49 |
| **1** | 2 | HALF | 13:52:59 | 13:53:02 | 13:53:19 | 13:53:35 | 49979 | 49982 | 49 |
| **2** | 4 | BASIC | 13:56:00 | 13:56:06 | 13:56:20 | 13:56:37 | 50160 | 50166 | 50 |
| **3** | 6 | BASIC | 13:58:10 | 13:58:17 | 13:58:31 | 13:58:45 | 50290 | 50297 | 50 |
| **4** | 9 | BASIC | 14:00:34 | 14:00:42 | 14:00:55 | 14:01:19 | 50434 | 50442 | 50 |

## Základní charakteristika datové sady

### Datové typy

In [4]:
```
df.dtypes
```

Out[4]:
```
id                int64
type_brick       object
time_start       object
time_verif       object
time_dest        object
time_end         object
time_start_sec    int64
time_verif_sec    int64
time_dest_sec     int64
time_end_sec      int64
type              int64
start_to_verif    int64
verif_to_dest     int64
dest_to_end       int64
total_time        int64
dtype: object
```

### Popis datové sady

In [5]:
```
df.describe()
```

Out[5]:

| | id | time_start_sec | time_verif_sec | time_dest_sec | time_end_sec | type | start_to_veri |
|---|---|---|---|---|---|---|---|
| **count** | 106.000000 | 106.000000 | 106.000000 | 106.00000 | 106.000000 | 106.000000 | 106.00000 |
| **mean** | 69.622642 | 53179.698113 | 53188.084906 | 53203.00000 | 53220.660377 | 1.292453 | 8.38679 |
| **std** | 37.319586 | 2881.268663 | 2881.518674 | 2880.72757 | 2879.756921 | 0.780317 | 3.43253 |
| **min** | 1.000000 | 48678.000000 | 48684.000000 | 48704.00000 | 48724.000000 | 1.000000 | 2.00000 |
| **25%** | 39.250000 | 50539.750000 | 50547.250000 | 50565.00000 | 50580.250000 | 1.000000 | 6.00000 |
| **50%** | 67.500000 | 51736.500000 | 51745.500000 | 51757.00000 | 51772.500000 | 1.000000 | 8.00000 |
| **75%** | 102.750000 | 55879.250000 | 55885.750000 | 55905.75000 | 55921.250000 | 1.000000 | 10.00000 |
| **max** | 136.000000 | 57450.000000 | 57467.000000 | 57473.00000 | 57482.000000 | 4.000000 | 21.00000 |

### Základní informace o datové sadě

In [6]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 106 entries, 0 to 105
Data columns (total 15 columns):
 #   Column          Non-Null Count  Dtype 
---  ------          --------------  ----- 
 0   id              106 non-null    int64 
 1   type_brick      106 non-null    object
 2   time_start      106 non-null    object
 3   time_verif      106 non-null    object
 4   time_dest       106 non-null    object
 5   time_end        106 non-null    object
 6   time_start_sec  106 non-null    int64 
 7   time_verif_sec  106 non-null    int64 
 8   time_dest_sec   106 non-null    int64 
 9   time_end_sec    106 non-null    int64 
 10  type            106 non-null    int64 
 11  start_to_verif  106 non-null    int64 
 12  verif_to_dest   106 non-null    int64 
 13  dest_to_end     106 non-null    int64 
 14  total_time      106 non-null    int64 
dtypes: int64(10), object(5)
memory usage: 12.6+ KB
```

## Proces standardizace dat (Data Standardization)

### Proces normalizace dat (Data Normalization)

Normalizace představuje proces transformace hodnot vybraných proměnných do srovnatelného rozsahu. Typické přístupy zahrnují standardizaci na nulovou střední hodnotu, úpravu rozptylu na jednotkovou hodnotu nebo lineární škálování do intervalu ⟨0, 1⟩.

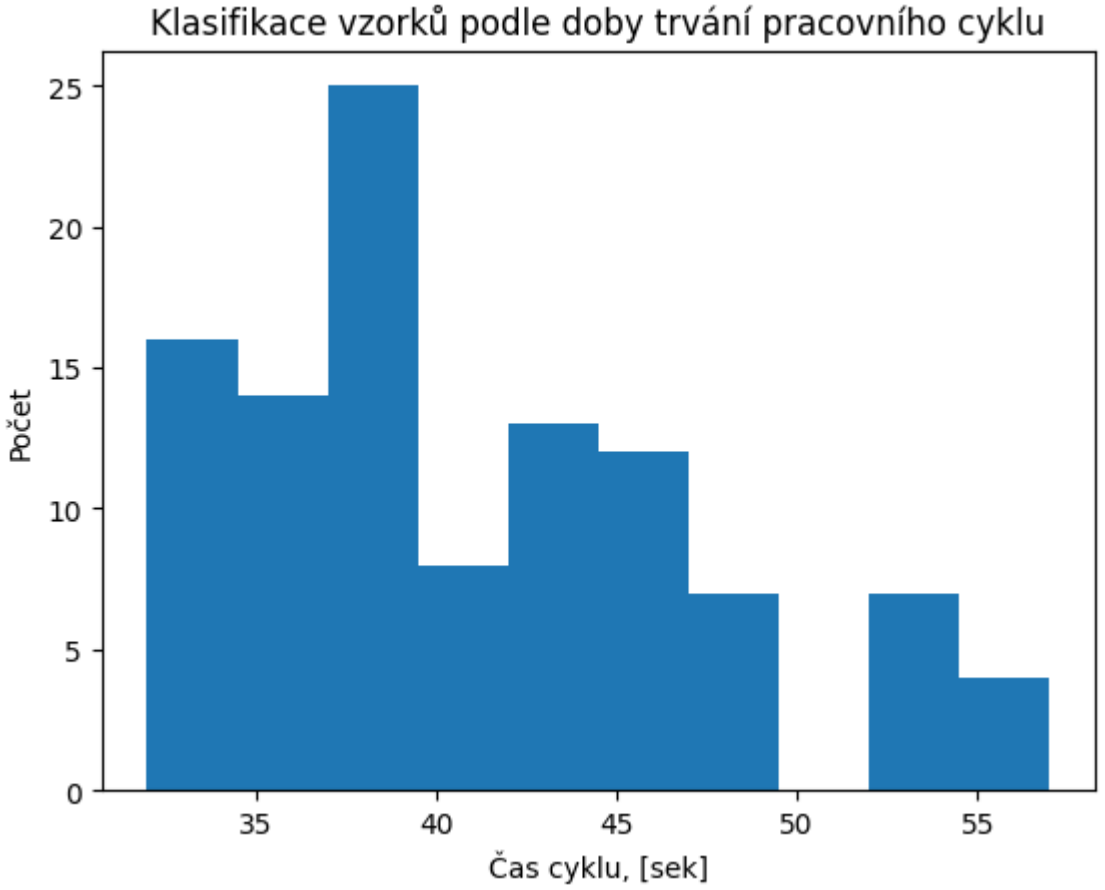
### Diskretizace spojitých proměnných (binning)

In [7]:
```
%matplotlib inline

plt.pyplot.hist(df["total_time"])
```

```
plt.pyplot.xlabel("Čas cyklu, [sek]")
plt.pyplot.ylabel("Počet")
plt.pyplot.title("Klasifikace vzorků podle doby trvání pracovního cyklu")
```

Out[7]: Text(0.5, 1.0, 'Klasifikace vzorků podle doby trvání pracovního cyklu')




In [8]:
```
# Definice intervalů (binů) pro diskrétní rozdělení dat
bins = np.linspace(min(df["total_time"]), max(df["total_time"]), 8)
bins
```

Out[8]:
```
array([32.        , 35.57142857, 39.14285714, 42.71428571, 46.28571429,
       49.85714286, 53.42857143, 57.        ])
```

In [9]:
```
# pojmenování intervalů (binů) pro diskrétní rozdělení dat
group_names = ['Extremely short','Very short','Short', 'Normal', 'Long','Very long','Extremely
```

In [10]:
```
# Kategorizace intervalů
df['total_time_binned'] = pd.cut(df['total_time'], bins, labels=group_names, include_lowest=Tr
df[['total_time','total_time_binned']].head(20)
```

Out[10]:

| | total_time | total_time_binned |
|---|---|---|
| **0** | 41 | Short |
| **1** | 36 | Very short |
| **2** | 37 | Very short |
| **3** | 35 | Extremely short |
| **4** | 45 | Normal |
| **5** | 34 | Extremely short |
| **6** | 34 | Extremely short |
| **7** | 32 | Extremely short |
| **8** | 47 | Long |
| **9** | 34 | Extremely short |
| **10** | 56 | Extremely long |
| **11** | 46 | Normal |
| **12** | 47 | Long |
| **13** | 44 | Normal |
| **14** | 44 | Normal |
| **15** | 44 | Normal |
| **16** | 44 | Normal |
| **17** | 46 | Normal |
| **18** | 46 | Normal |
| **19** | 46 | Normal |

In [11]:
```
# Výpočet počtu vzorků v intervalech
df["total_time"].value_counts()
```

Out[11]:

| total_time | |
|---|---|
| 36 | 10 |
| 38 | 9 |
| 46 | 9 |
| 39 | 9 |
| 37 | 7 |
| 32 | 7 |
| 34 | 6 |
| 44 | 6 |
| 47 | 5 |
| 41 | 5 |
| 35 | 4 |
| 52 | 4 |
| 43 | 4 |
| 45 | 3 |
| 42 | 3 |
| 40 | 3 |
| 33 | 3 |
| 57 | 2 |
| 56 | 2 |
| 54 | 2 |
| 49 | 1 |
| 53 | 1 |
| 48 | 1 |

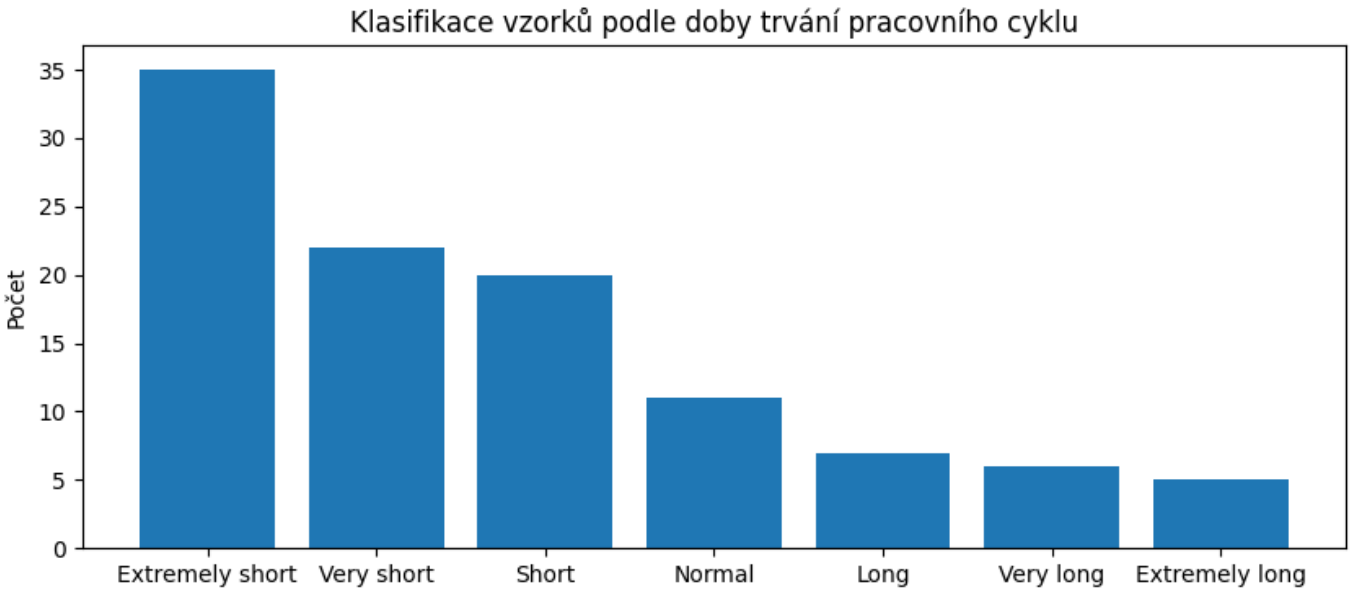
Name: count, dtype: int64

## Grafické znázornění intervalového rozdělení

In [12]:
```
%matplotlib inline
pyplot.figure(figsize=(10,4))
pyplot.bar(group_names, df["total_time_binned"].value_counts(), )

pyplot.ylabel("Počet")
pyplot.title("Klasifikace vzorků podle doby trvání pracovního cyklu")
```

Out[12]: Text(0.5, 1.0, 'Klasifikace vzorků podle doby trvání pracovního cyklu')



In [13]:
```
# Plot density
df['total_time'].plot.density(bw_method='scott', linestyle='-', linewidth=2, label='Reálná dat
pyplot.legend()
pyplot.xlabel("Doba pracovního cyklu")
pyplot.ylabel("Hustotní rozdělení")
pyplot.title('Hustotní rozdělení reálných dat')
pyplot.show()
```


## Indikátorová (dummy) proměnná

In [14]:
```
df.columns
```

Out[14]:
```
Index(['id', 'type_brick', 'time_start', 'time_verif', 'time_dest', 'time_end',
       'time_start_sec', 'time_verif_sec', 'time_dest_sec', 'time_end_sec',
       'type', 'start_to_verif', 'verif_to_dest', 'dest_to_end', 'total_time',
       'total_time_binned'],
      dtype='object')
```

In [15]:
```
dummy_variable_1 = pd.get_dummies(df["type_brick"])
dummy_variable_1.head()
```

Out[15]:

| | BASIC | CORNER | END | HALF |
|---|---|---|---|---|
| **0** | False | True | False | False |
| **1** | False | False | False | True |
| **2** | True | False | False | False |
| **3** | True | False | False | False |
| **4** | True | False | False | False |

In [16]:
```
# Změna názvů sloupců pro větší přehlednost
```

```
dummy_variable_1.rename(columns={'BASIC':'brick_basic', 'CORNER':'brick_corner', 'HALF':'brick
dummy_variable_1.head()
```

Out[16]:

| | brick_basic | brick_corner | brick_end | brick_half |
|---|---|---|---|---|
| **0** | False | True | False | False |
| **1** | False | False | False | True |
| **2** | True | False | False | False |
| **3** | True | False | False | False |
| **4** | True | False | False | False |

In [17]:
```
# Sloučení datových rámců "df" a "dummy_variable_1"
df = pd.concat([df, dummy_variable_1], axis=1)
df.head()
```

Out[17]:

| | id | type_brick | time_start | time_verif | time_dest | time_end | time_start_sec | time_verif_sec | time_dest |
|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | CORNER | 13:52:18 | 13:52:24 | 13:52:41 | 13:52:59 | 49938 | 49944 | 49 |
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## Export datové sady do formátu CSV

In [18]:
```
df.to_csv('../../data/01_DataScience/exploration_timelaps.csv', index=False)
```

## Autor / Organizace / Datum

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Přehled změn

| Datum (YYYY-MM-DD) | Verze | Autor změny | Popis změny |
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| 2026-01-20 | 1.1 | Vjačeslav Usmanov | added DS_02_Exploration.ipynb |
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