

# PRACTICAL-4

Aim: Write a program for a 6-city symmetric TSP using a brute-force approach. Write a program for a 6-city symmetric TSP using a nearest neighbor heuristic

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In [1]:

```
import pandas as pd
import time
mat = pd.read_csv("4.csv", header=None).values
print(mat)
print(mat.dtype)
```

```
[0  64 378 519 434 200]
[ 64  0 318 455 375 164]
[378 318  0 170 265 344]
[519 455 170  0 223 428]
[434 375 265 233  0 273]
[200 164 344 428 273  0]]
int64
```

In [4]:

```
from itertools import permutations
citynames=list(range(mat.shape[0]))
per=permutations(citynames)
per=list(per)
print(len(per))
print(per)
```

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```
In [18]: import numpy as np
st=time.process_time()
print(st)
besttourlength=np.inf
for tour in per:
    tourlength=0
    for i in range(len(tour)-1):
        tourlength+=mat[tour[i],tour[i+1]]
    tourlength+=mat[tour[i+1],tour[0]]
    if tourlength<besttourlength:
        besttourlength=tourlength
        besttour=tour
et=time.process_time()
time_taken=(et-st)*1000
print("Best Tour Path:",besttour)
print("Best Tour Path distance:",besttourlength)
print("Time taken",time_taken)
```

1.921875  
Best Tour Path: (0, 1, 2, 4, 5)  
Best Tour Path distance: 1120  
Time taken 0.0

```
In [16]: from itertools import permutations
startcity=int(input("Enter Start City index:"))
citynames=list(range(mat.shape[0]))
citynames.remove(startcity)
per=permutations(citynames)
per=list(per)
st=time.process_time()
print(st)
besttourlength=np.inf
for tour in per:
    tourlength=0
    for i in range(len(tour)-1):
        tourlength+=mat[tour[i],tour[i+1]]
    tourlength+=mat[tour[-1],startcity]
    tourlength+=mat[startcity,tour[0]]
    if tourlength<besttourlength:
        besttourlength=tourlength
        besttour=list(tour)
et=time.process_time()
time_taken=(et-st)*1000
besttour.insert(0,startcity)
besttour.append(startcity)
print("Best Tour Path:",besttour)
print("Best Tour Path distance:",besttourlength)
```

1.890625  
Best Tour Path: [3, 4, 5, 0, 1, 2, 3]  
Best Tour Path distance: 1248  
Time taken 0.0

In [ ]:

```
In [3]: import pandas as pd
import time
```

```

import numpy as np
mat=pd.read_csv("4.csv",header=None).values.astype(float)
startcity=int(input("Enter the Start City from 0 to"+str(mat.shape[0]-1)+":"))
st=time.process_time()
tourlength=0
besttour=[startcity]
mat[mat==0]=np.inf
print(mat)
matorigcopy=mat.copy()
for i in range(mat.shape[0]-1):
    if i ==0:
        tourlength+=min(mat[startcity,:])
        nextbestind=np.argmin(mat[startcity,:])
        besttour.append(nextbestind)
        mat[:,nextbestind]=np.inf
        mat[:,startcity]=np.inf
    else:
        tourlength+=mat[nextbestind,np.argmin(mat[nextbestind,:])]
        nextbestind=np.argmin(mat[nextbestind,:])
        mat[:,nextbestind]=np.inf
        besttour.append(nextbestind)
tourlength+=matorigcopy[nextbestind,startcity]
et=time.process_time()
time_taken=(et-st)*1000
besttour.append(startcity)
print("Best Tour Path:",besttour)
print("Best Tour Path distance:",tourlength-10)

```

```

[[ inf  64. 378. 519. 434. 200.]
 [ 64.   inf 318. 455. 375. 164.]
 [378. 318.   inf 170. 265. 344.]
 [519. 455. 170.   inf 223. 428.]
 [434. 375. 265. 233.   inf 273.]
 [200. 164. 344. 428. 273.   inf]]
Best Tour Path: [1, 0, 5, 4, 3, 2, 1]
Best Tour Path distance: 1248.0
Time taken 0.0

```