In [17]:

```python
import matplotlib.pyplot as plt
import numpy as np


n = 5000000
m = int(n / 8)
P_arr = [1, 2, 4, 8, 16]
T_m_arr = [0.858828, 0.449047, 0.450495, 0.461504, 0.455435]
T_q_arr = [0.842364, 0.835869, 0.840945, 0.838360, 0.867618]


plt.figure(figsize=(14, 8))
plt.xlabel('$P$',size = 20)
plt.ylabel('$T$',size = 20)
plt.title('$T(P)$', size = 30)
plt.grid(ls=':')
plt.scatter(P_arr, T_m_arr)
plt.scatter(P_arr, T_q_arr)

plt.plot(P_arr, T_m_arr, label = 'mergesort time', color = 'black')
plt.plot(P_arr, T_q_arr, label = 'quicksort time', color = 'red')
plt.legend()
plt.show()
```
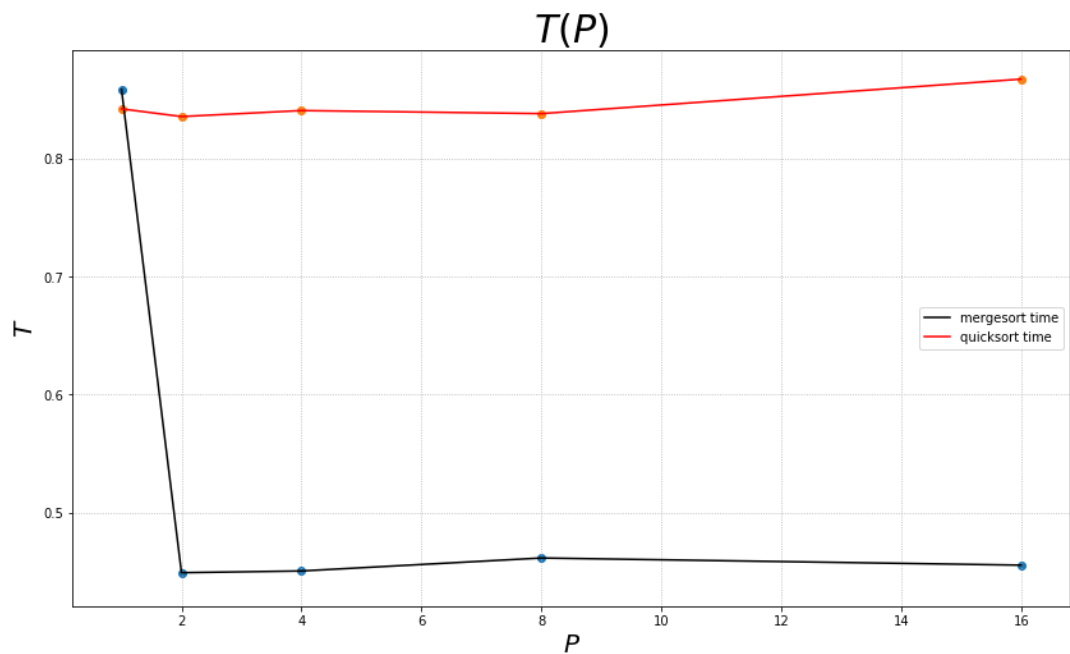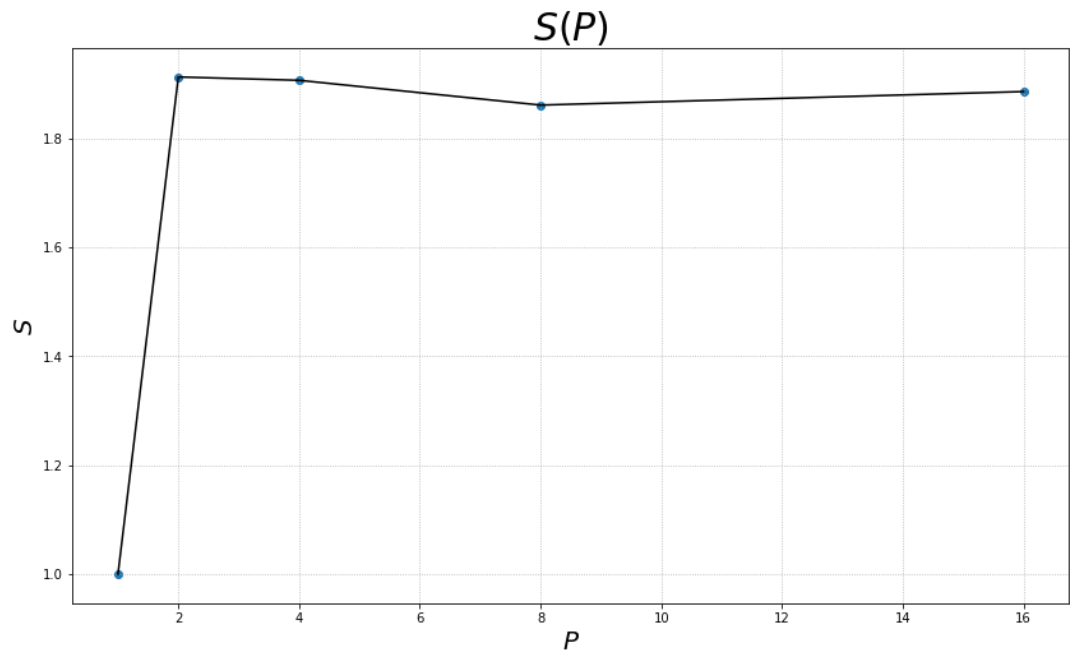
In [23]:
```python
S_arr = [T_m_arr[0] / T_m_arr[i] for i in range(5)]


plt.figure(figsize=(14, 8))
plt.xlabel('$P$',size = 20)
plt.ylabel('$S$',size = 20)
plt.title('$S(P)$', size = 30)
plt.grid(ls=':')
plt.scatter(P_arr, S_arr)


plt.plot(P_arr, S_arr, color = 'black')
plt.legend()
plt.show()
```

In [22]:
```python
E_arr = [S_arr[i] / P_arr[i] for i in range(5)]

plt.figure(figsize=(14, 8))
plt.xlabel('$P$',size = 20)
plt.ylabel('$E$',size = 20)
plt.title('$E(P)$', size = 30)
plt.grid(ls=':')
plt.scatter(P_arr, E_arr)


plt.plot(P_arr, E_arr, color = 'black')
plt.legend()
plt.show()
```
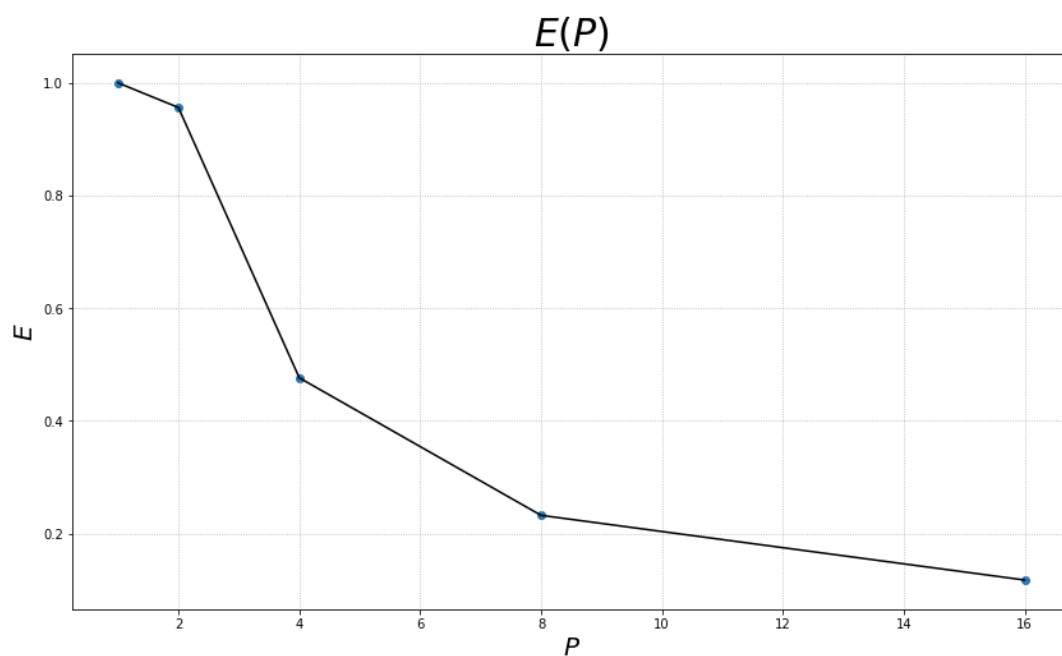

In [ ]: