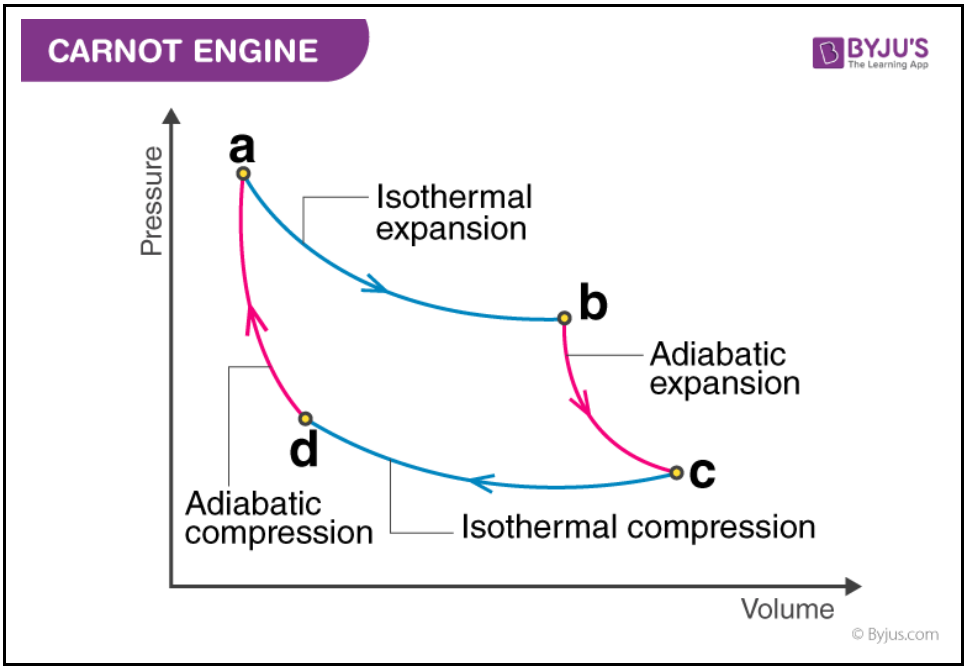
CSE 218, January 2021 Term
Online on Interpolation
Time for Work!

Remember, Carnot engine. The Carnot engine is a theoretical thermodynamic cycle proposed by **Leonard Carnot**. It gives the estimate of the maximum possible efficiency that a heat engine during the conversion process of heat into work and conversely, working between two reservoirs, can possess. The following figure demonstrates different process steps of the Carnot engine.



The provided **pressure.txt** file contains the pressure (Pa) of the gas at different volumes (m^3) of first two steps (ab & bc). Assume that the process shift occurs at volume **$30m^3$** (b point in graph). Now, you have the following tasks.

(1) Calculate pressure(Pa) at volume **V= $28m^3$** and **V = $32m^3$** , using third order polynomials of Lagrange Cubic Interpolation method.(You can not use any Python scientific library to directly calculate the interpolated value). Also, find the absolute approximate relative error. Finally, plot a graph for showing the pressure as a time of volume for both processes and indicate the interpolated values in the graph. **[5+5+2+3]**

(2) Calculate the work done by the gas between volume **V=$25m^3$ to V=$35m^3$**. Note that,
$W = \int PdV$ **[5]**
(You can use the Python SimPy library to calculate the integration function. Sample code is attached)

```
from sympy import *
x = Symbol('x')
f = (x-4)*(x+8)
f_prime = integrate(f)
print(f)
print(f_prime)
f_prime = lambdify(x, f_prime)
print(f_prime(1))
```