What this code is about

The C++ code result.cpp computes the ground state energy $E_0^{(3)}(\beta)$ for the sextic anharmonic oscillator

$$E^{(3)}(\beta) = 1 + \sum_{k=0}^{\infty} \frac{(-1)^k}{\beta^k} \mu_{-(2k+2)} + \Delta(\beta) \tag{1}$$

The second term in the right hand side above is given by

$$\sum_{k=0}^{\infty} \frac{(-1)^k \mu_{-(2k+2)}}{\beta^k} = \sum_{k=0}^{\lfloor \frac{d}{2} \rfloor - 1} \frac{(-1)^k}{\beta^k} \left(A_{2k} + B_{2k} + C_{2k} \right) + \sum_{k=\lfloor \frac{d}{2} \rfloor}^{\infty} \frac{(-1)^k}{\beta^k} D_{2k}, \tag{2}$$

where

$$A_k = \sum_{m=0}^{k} c_m m! \sum_{l=0}^{m} \frac{(-1)^l}{(l!)^2 (m-l)!} \fint_0^{\infty} \frac{e^{-x/2}}{x^{k+\nu+1-l}} \mathrm{d}x, \tag{3}$$

$$B_k = \sum_{m=k+1}^{d} c_m m! \sum_{l=0}^{k} \frac{(-1)^l}{(l!)^2 (m-l)!} \fint_0^{\infty} \frac{e^{-x/2}}{x^{k+\nu+1-l}} \mathrm{d}x, \tag{4}$$

$$C_k = \sum_{m=k+1}^{d} c_m m! \sum_{l=k+1}^{m} \frac{(-1)^l \, \Gamma(l-k-\nu) 2^{l-k-\nu}}{(l!)^2 (m-l)!}, \tag{5}$$

and

$$D_k = \sum_{m=0}^{d} c_m m! \sum_{l=0}^{m} \frac{(-1)^l}{(l!)^2 (m-l)!} \fint_0^{\infty} \frac{e^{-x/2}}{x^{k+\nu+1-l}} \mathrm{d}x. \tag{6}$$

The finite part integrals appearing above are given by,

$$\fint_0^{\infty} \frac{e^{-x/2}}{x^{k+\nu+1-l}} \mathrm{d}x = \frac{(-1)^{k-l+1} \left(\frac{1}{2}\right)^{k-l+1+\nu} \pi}{\Gamma(k-l+1+\nu) \sin(\pi\nu)}, \tag{7}$$

with $\nu = -1/2$. The third term of the right-hand side of equation (1),

$$\Delta(\beta) = \frac{\pi \, \beta^{(1+\nu)/2}}{\sin(\pi\nu)} \left(\cos\left(\frac{\pi\nu}{2}\right) \mathrm{Im}\, g\left(i/\sqrt{\beta}\right) + \sin\left(\frac{\pi\nu}{2}\right) \mathrm{Re}\, g\left(i/\sqrt{\beta}\right) \right), \tag{8}$$

where

$$g(x) = e^{-x/2} \sum_{m=0}^{\infty} c_m m! \sum_{k=0}^{m} \frac{(-x)^k}{(k!)^2(m-k)!}. \tag{9}$$

The terms in (2) for various $\beta = 10^{-2} - 10^{25}, 0.2$ and $\beta = 4$ are read-in from files FIRST.txt, SECOND.txt, THIRD.txt, FOURTH.txt while the third term in equation (1) is read-in from FIFTH.txt. The result for $E_0(\beta)$ is written to the file disectres.txt

The file compile.job is a SLURM script to compile the code in an HPC and generate an executable.

The file together.job is a SLURM script to run the executable in an HPC.