Problem 1.8

(a) Using parameters $N = 40$, $E = 40$, and $d = 3$, the mean energy of the demon $\langle E_d \rangle$, after running the program for some time, starts to approach a steady value.

(b) After running the program for a reasonable time (> 100000 mcs), the mean energy of the demon $\langle E_d \rangle$ appears to have stabilized at a value of 0.655, while system mean energy $\langle E \rangle$ appears to have stabilized at a value of 39.345, which corresponds to a $\langle E \rangle / N$ value of 0.984, indicating that the mean energy per particle is greater than the demon's mean energy. The ratio $\nu = \frac{\langle E_d \rangle}{\langle E \rangle / N}$ is 0.667.

(c) Doubling the value of E and running the program for the same amount of time, $\langle E_d \rangle$ and $\langle E \rangle / N$ respectively approach values of 1.313 and 1.967, corresponding to the ratio $\nu = 0.668$.

Table 1: Energy values for different N and E.

N	E	$\langle E_d \rangle$	$\langle E \rangle$	$\langle E \rangle / N$	$\nu = \langle E_d \rangle \langle E \rangle^{-1} N$
40	40	0.655	39.345	0.984	0.667
60	40	0.436	39.564	0.659	0.662
80	40	0.331	39.669	0.496	0.667
100	40	0.265	39.735	0.397	0.667
40	80	0.531	79.469	1.987	0.267