Computer Architecture
HW #1

1.9 a. 50%

b. Energy = ½ load × V^2. Changing the frequency does not affect energy–only power. So the new energy is ½ load × (½ V)^2, reducing it to about ¼ the old energy.

1.10

Power consumption @ most of time: 0.9

(a) Turn off 60%, work load of the other 40% grows to 100%

40% * 1 = 0.4

Power saving: (0.9 – 0.4) / 0.9 = 55.55%

(b) 0.4 * 1 + 0.6 * 20% = 0.52

Power saving: (0.9 – 0.52) / 0.9 = 42.22%

(c) Max power 降為 0.8^2 · 0.6 = 0.384 (此時work load應為滿載)

Power saving: (0.9 – 0.384) / 0.9 = 57.3 %

(d) 40% + 30% * 20% + 30% * 0 = 0.46

Power saving: (0.9 – 0.46) / 0.9 = 48.8%

1.15 a. old execution time = 0.5 new + 0.5 × 10 new = 5.5 new

b. In the original code, the unenhanced part is equal in time to the enhanced part sped up by 10, therefore:

(1 – x) = x/10

10 – 10x = x

10 = 11x

10/11 = x = 0.91

1.16 a. 1/(0.8 + 0.20/2) = 1.11

b. 1/(0.7 + 0.20/2 + 0.10 × 3/2) = 1.05

c. fp ops: 0.1/0.95 = 10.5%, cache: 0.15/0.95 = 15.8%

1.17 a. 1/(0.6 + 0.4/2) = 1.25

b. 1/(0.01 + 0.99/2) = 1.98

c. 1/(0.2 + 0.8 × 0.6 + 0.8 × 0.4/2) = 1/(.2 + .48 + .16) = 1.19

d. 1/(0.8 + 0.2 × .01 + 0.2 × 0.99/2) = 1/(0.8 + 0.002 + 0.099) = 1.11

1.18 a. $1/(.2 + .8/N)$

b. $1/(.2 + 8 \times 0.005 + 0.8/8) = 2.94$

c. $1/(.2 + 3 \times 0.005 + 0.8/8) = 3.17$

d. $1/(.2 + \log N \times 0.005 + 0.8/N)$

e. $d/dN(1/((1 - P) + \log N \times 0.005 + P/N)) = 0$