CA Hw1
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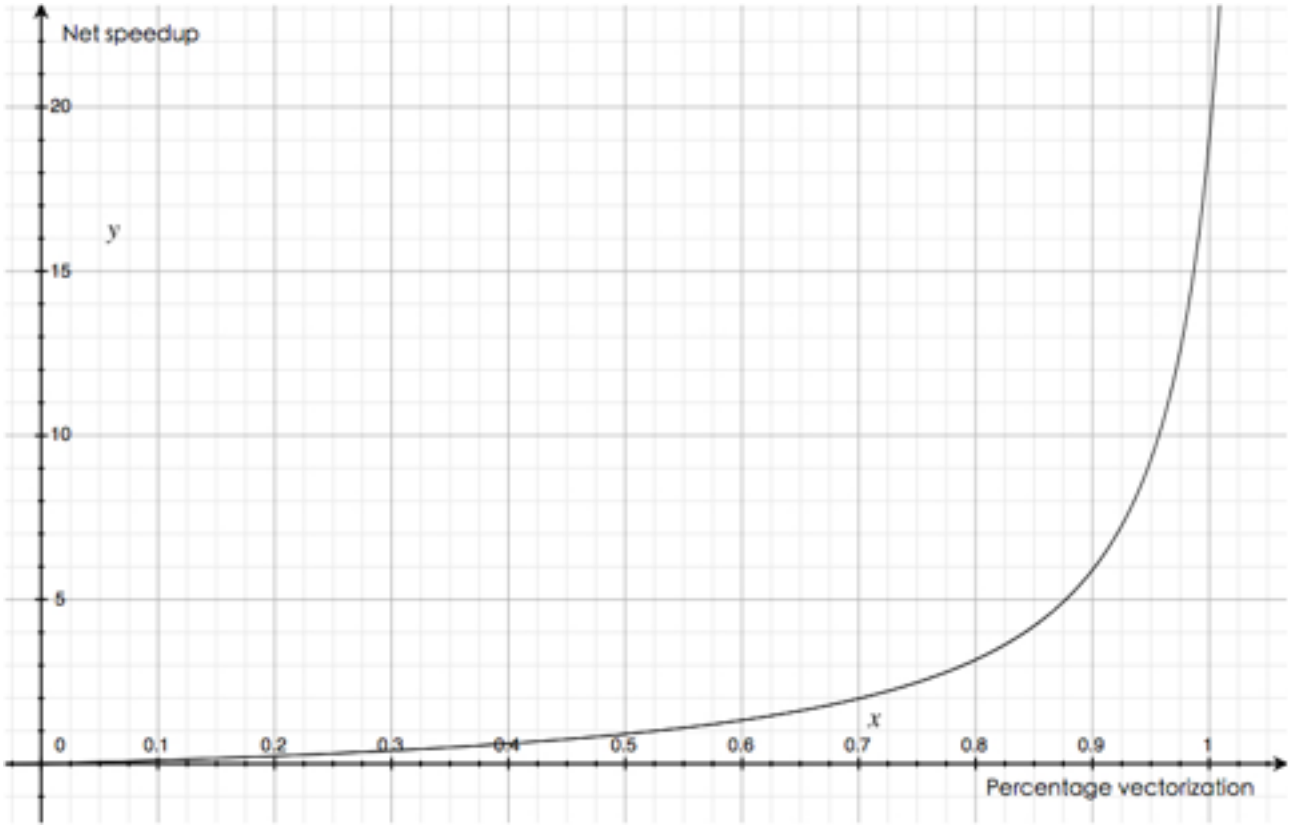
1.1

a. Let percent be p, so the net speedup is 1/(1-p+p/20)-1=19p/(20-19p), 0<=p<=1, the graph is as below:



b. 1/(1-p+p/20)=2, the result of p is 10/19.
c. The max speedup is 20 when p is 100%. One-half of 20 is 10, so 1/(1-p+p/20)=10. The result is 18/19.
d. The former improvement is 1/(1-0.7+0.7/20)=200/67, and the improvement after hardware design is 1/(1-0.7+0.7/40)=400/127. If we want to get the same performance, 1/(1-p+p/20)=400/127, p need to be 273/380=71.84%, increasing almost 1.84%. I'd like to invest on the training of programmer to let them use more vector.

1.2

a. Assume that the time after enhanced is T, the fast mode runs 0.5T, which is 0.5*10T=5T finished by original mode. So the speedup is (5T+0.5T)/T=5.5.
b. The percentage is 5T/5.5T=10/11=90.9%

1.3

a. 1*0.6+2*0.2+3*0.2=1.6 cycles/instruction
b. 1*0.6+2*0.2+(1*0.5+3*0.5)*0.2=1.4 cycles/instruction
c. (1.6/2)/(1.4/1.8)=36/35=1.03, faster, the speedup is 1.03.

1.4

a. (79W+3.7W*2+7.9W*2)/0.7=146W
b. 7.9W*0.6+4W*0.4=6.34W

1.13

a. Assume that p percentage of time is for enhancement3, 1/(0.3/30+0.3/20+p/10+0.4-p)=10, the result is 13/36=36.11%.
b. Assume the use time is T totally. Time of enhancement1 is 0.3T/30=0.01T; Time of enhancement2 is 0.3T/20=0.015T; Time of enhancement3 is 0.2T/10=0.02T;Time of no enhancement is 0.2T. So the fraction is 0.2T/(0.01T+0.015T+0.02T+0.2T)=40/49=81.63%
c. One enhancement:enhancements1 is of course better than 2, which is 1/(0.85+0.15/30)=200/171=1.17;enhancements 3 is 1/(0.3+0.7/10)=100/37=2.7. So choose enhancement 3.
   Two enhancement: It's of course that enhancement 1+3 is better than enhancement 2+3, so let's just compare 1+3 and 1+2.
   1+3: 1/(0.15/30+0.7/10+0.15)=40/9=4.44;
   1+2: 1/(0.15/30+0.15/20+0.7)=1.40.
   So choose enhancement 1+3