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Homework Two

2.1.2

a) The basic operation for the definition-based algorithm is addition. Addition is performed $2n^2$ times as a function of the matrix order n. The addition operation is performed as a function of the matrix order n half of the total number of elements in the matrices times which is $2n^2/2$ times.
b) The basic operation for the definition-based algorithm is multiplication. Multiplication is performed n^3 times as a function of the matrix order n. The multiplication operation is performed as a function of the matrix order n (total elements) * (n/2) times which is n^3 times.

2.1.4

a) The smallest number of gloves you need to select to have at least one matching pair in the best case is 2. In the worst case it would take 12 gloves to have at least one matching pair.
b) There are 45 possible outcomes. There as 5 best case outcomes so the probability of a best case outcome is 1/9. Since only 5 cases are best case, there are 40 worst case outcomes so the probability of a worst case outcome is 8/9. The number of pairs to be expected in the average case are (4) * (1/9) + (3) * (8/9) which is 28/9.

2.1.5

a) Proof:
    a. $2^{b-1} <= n + 1 <= 2^b$
    b. $\log_2 2^{b-1} < \log_2(n) +1 <= \log_2 2^b$
    c. $b – 1 < \log_2(n) + 1 <= b$
    d. $\log_2(n) + 1 = b$
b) Proof:
    a. $2^{b-1} <= n + 1 <= 2^b$
    b. $\log_2 2^{b-1} < \log_2(n+1) <= \log_2 2^b$
    c. $b – 1 < \log_2(n+1) <= b$
    d. $\log_2(n+1) = b$
c) The analogous formula for the number of decimal digits is the floor of $\log_{10}(n) + 1$, where n is a binary value.
d) Within the accepted analysis framework, it does not matter whether we use binary or decimal digits in measuring n's size because logarithms can be used to easily convert between binary and decimal.

2.1.7

a) If the Gaussian elimination is to work on a system of 1000 equations versus a system of 500 equations, it will take 8 times longer because it will take $(8/3)n^3$ instead of $(1/3)n^3$.

b) The new computer will have a speed of $1000(1/3)n^3$. The difference between this and the old computer speed is 10 and can be found by setting both equal to each other. Therefore, the r computer will increase the sizes of systems solvable in the same amount of time as on the old computer by a factor of 10.

2.1.9

a) X same as Y
b) X lower than Y
c) X same as Y
d) X higher than Y
e) X same as Y
f) X lower than Y