4. Estimate

1-19. *Soln.*
(1) There are about 30 books and 300 pages per book. So roughly 30*300=9,000 pages.
(2) There are about 300 pages per book, 100 books per shelf, and 16 shelves. So roughly 300*100*16=480,000 pages.

1-20. *Soln.*
There are about 13 words per line, 30 lines per page, and 730 pages. So the textbook has roughly 13*30*730=284,700 words.

1-21. *Soln.*
(1) One hour is 3,600 seconds. $\frac{10^6}{10^4} = 100$ and $\frac{10^4}{3.6 * 10^3} \approx \frac{10}{4} \approx 3$. So roughly 100*3=300 hours.
(2) 10^6 seconds is roughly 300 hours, and one day is 24 hours. $\frac{300}{100} = 3$ and $\frac{100}{2.4 * 10} \approx \frac{10}{2} = 5$. So roughly 3*5=15 days.

1-22. *Soln.*
(1) There are 50 states and about 6 cities per state. So roughly 6*50=300 cities.
(2) There are about 300 cities and 50 towns per city. So roughly 300*50=15,000 towns.

1-23. *Soln.* Suppose the river is 1 km wide, 0.04 km deep and the water is flowing at 3 km/h, and one day is 24 hours. So 1[km]*0.04[km]*3[km/h]*24[h]=2.88[km^3] flow through the river each day.

1-24. *Soln.*
(1) The access time of a disk drive depends on the speed of certain mechanical parts, so milliseconds are most likely.
(2) RAM needs to be accessed constantly while a program is running, so more than a microsecond is most likely.
(3) Suppose the CPU has a clock speed of 2.5 [GHz] or $2.5 * 10^9$ [Hz], and 2 [CPI] on average. One year is 3.156*10^7 [s], so $\frac{3.156 * 10^7[s] * 2.5 * 10^9[Hz]}{2[CPI]} \approx 3.945 * 10^{16}$ instructions per year.

1-25. *Soln.*
(1) The algorithm sorts $1,000^2[n^2/s]$, so it will take $\frac{10,000^2[n^2]}{1,000^2[n^2/s]} = 100[s]$.
(2) The algorithm sorts $10^3 log 10^3[nlogn/s]$, so it will take $\frac{10^4 log(10^4)}{10^3 log(10^3)} = \frac{4 * 10^4}{3 * 10^3} = 13.33[s]$.