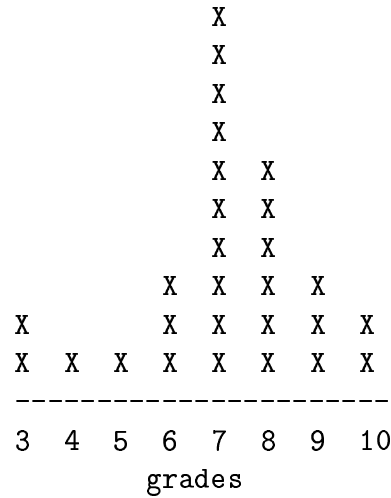


Analysis of Algorithms: Solutions 8



Problem 1

Write an efficient algorithm for scheduling several lectures, using as few lecture halls as possible. For each lecture i , we know its start time s_i and finish time f_i .

GREEDY-HALL-SELECTOR(s, f, n)

sort lectures in the ascending order of their finish times

$assigned \leftarrow 0$ ▷ number of lectures already assigned to specific halls

$halls \leftarrow 0$ ▷ number of lecture halls

for $i \leftarrow 1$ **to** n

do $hall_i \leftarrow 0$ ▷ hall for the i th lecture; 0 means “no specific hall yet”

while $assigned < n$

do $halls \leftarrow halls + 1$

$finish \leftarrow -\infty$

for $i \leftarrow 1$ **to** n ▷ in sorted order

do if $hall_i = 0$ and $s_i \geq finish$

then $hall_i \leftarrow halls$

$finish \leftarrow f_i$

$assigned \leftarrow assigned + 1$

return $hall_1..hall_n$ ▷ array of hall assignments

The time complexity of this algorithm is $O(n \cdot halls)$, where n is the number of lectures and $halls$ is the final number of halls.

Problem 2

Imagine that you need to pay n cents, using the smallest possible number of coins. You have an unlimited supply of quarters, dimes, nickels, and pennies. Give an efficient algorithm that finds the minimal set of coins for a given amount n .

FEWEST-COINS(n)

$quarters \leftarrow \lfloor \frac{n}{25} \rfloor$

$n \leftarrow n - 25 \cdot quarters$

$dimes \leftarrow \lfloor \frac{n}{10} \rfloor$

$n \leftarrow n - 10 \cdot dimes$

$nickels \leftarrow \lfloor \frac{n}{5} \rfloor$

$n \leftarrow n - 5 \cdot nickels$

$pennies \leftarrow n$

return $quarters, dimes, nickels, pennies$

Problem 3

Using Figure 17.4(b) in the textbook as a model, draw an optimal-code tree for the following set of characters and their frequencies:

a:4 b:6 c:10 d:12 e:18 f:40 g:50 h:60

