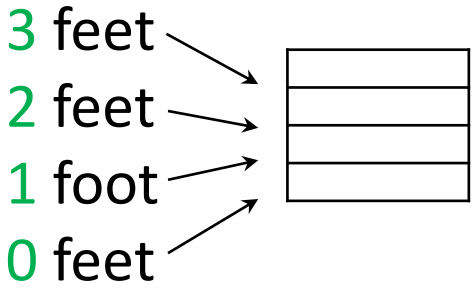
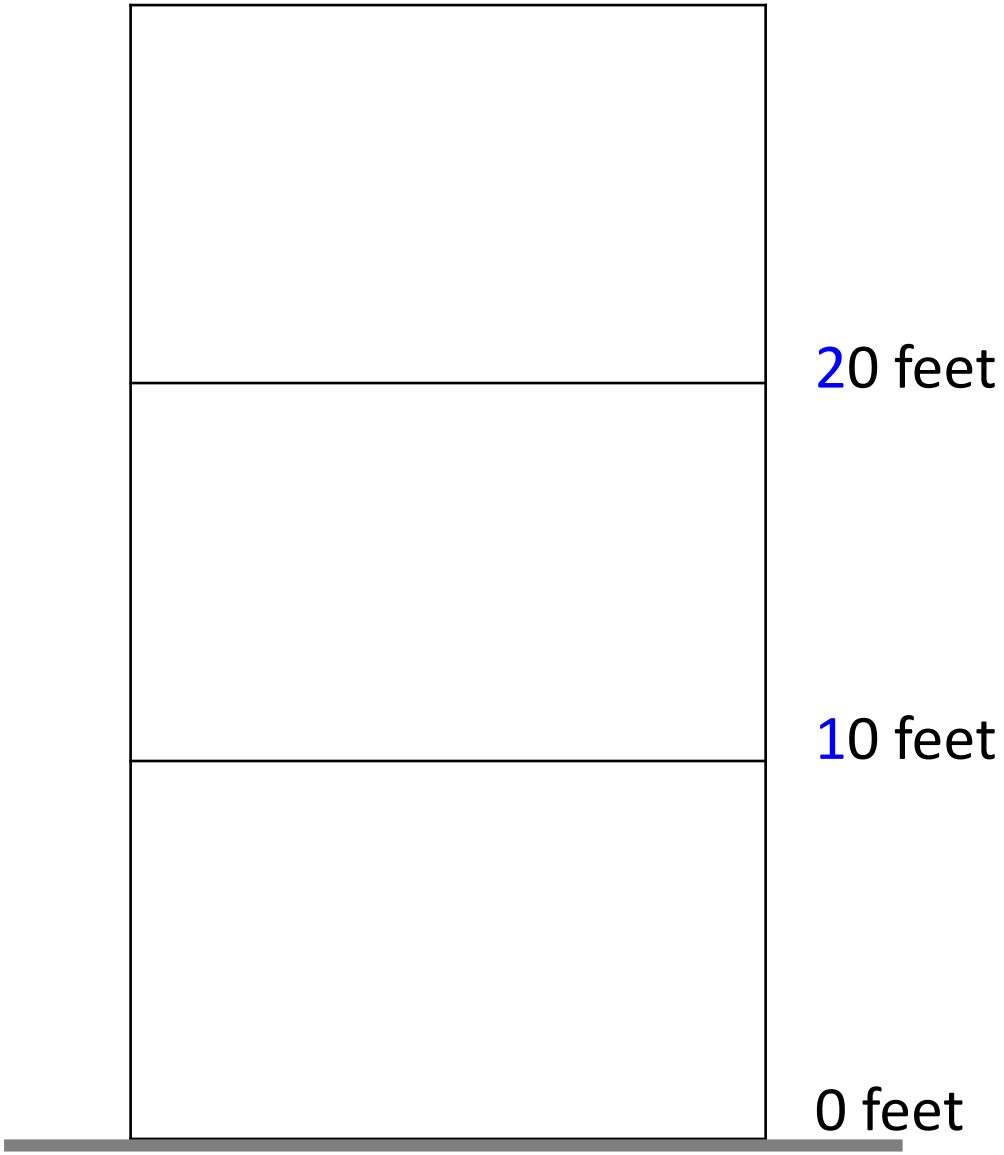
Address Translation Version 1

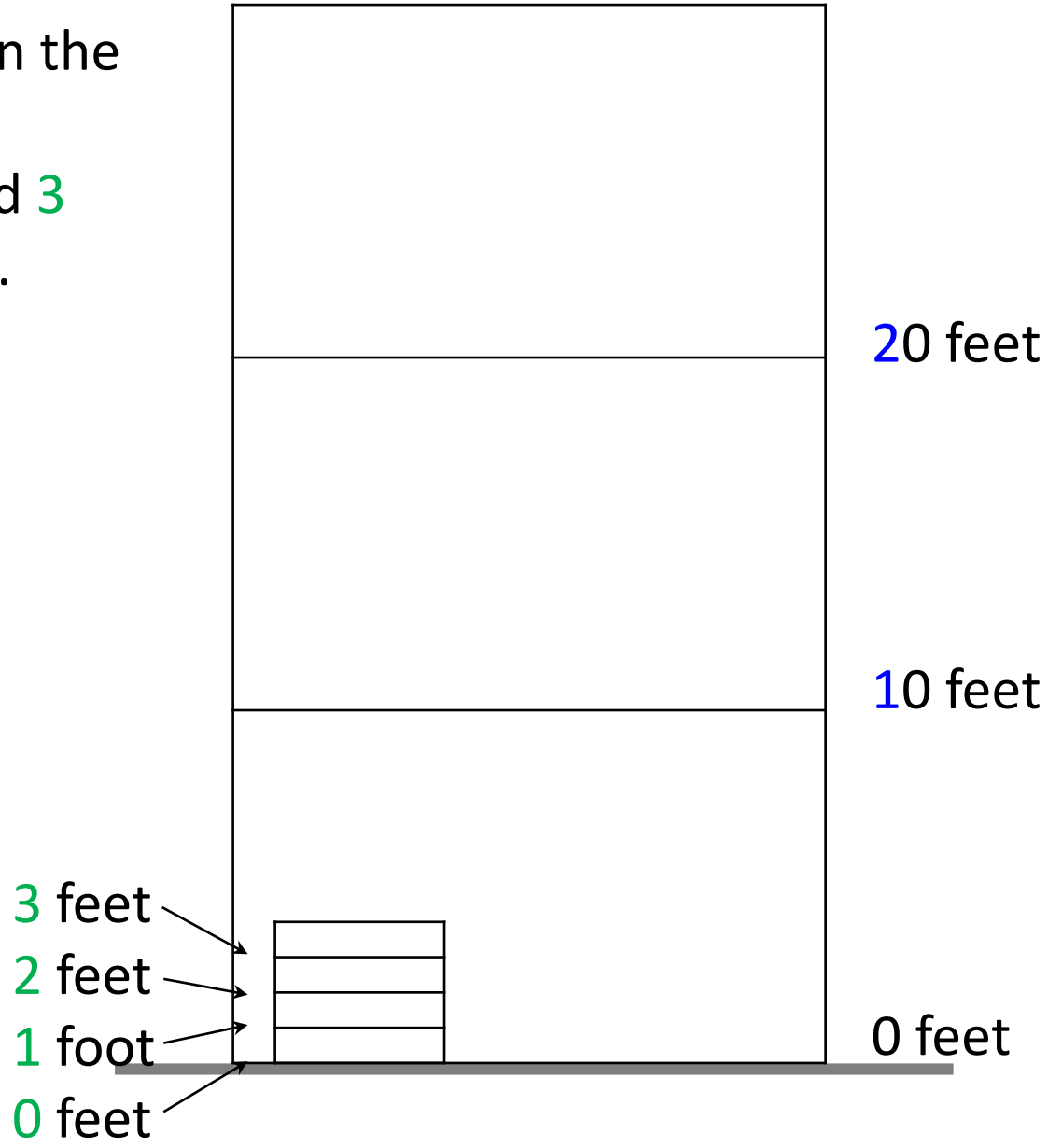
You have a bookcase with shelves that are 0, 1, 2 and 3 feet from the *floor*.



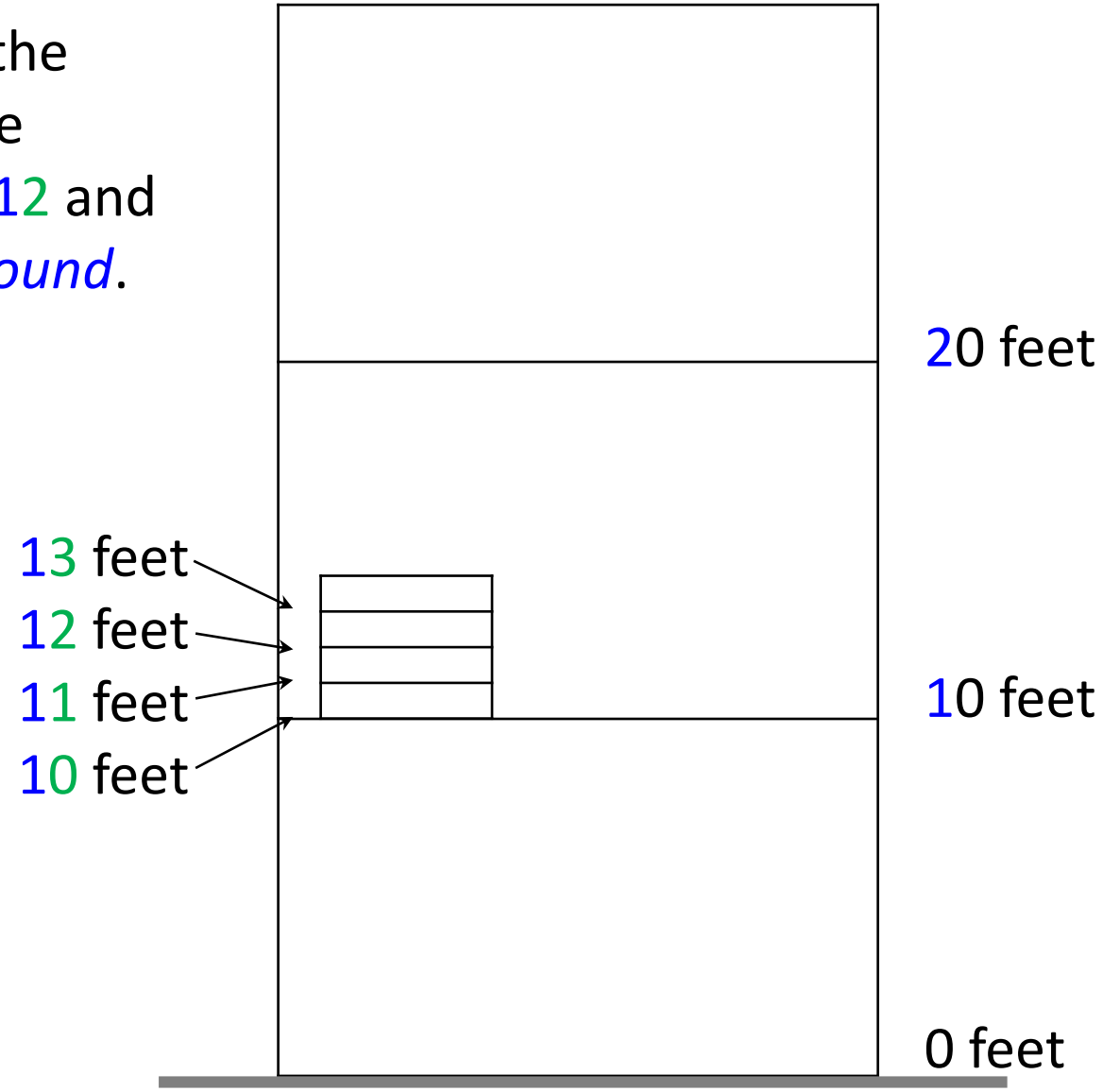
You have a house with floors that are 0, 10 and 20 feet from the *ground*.



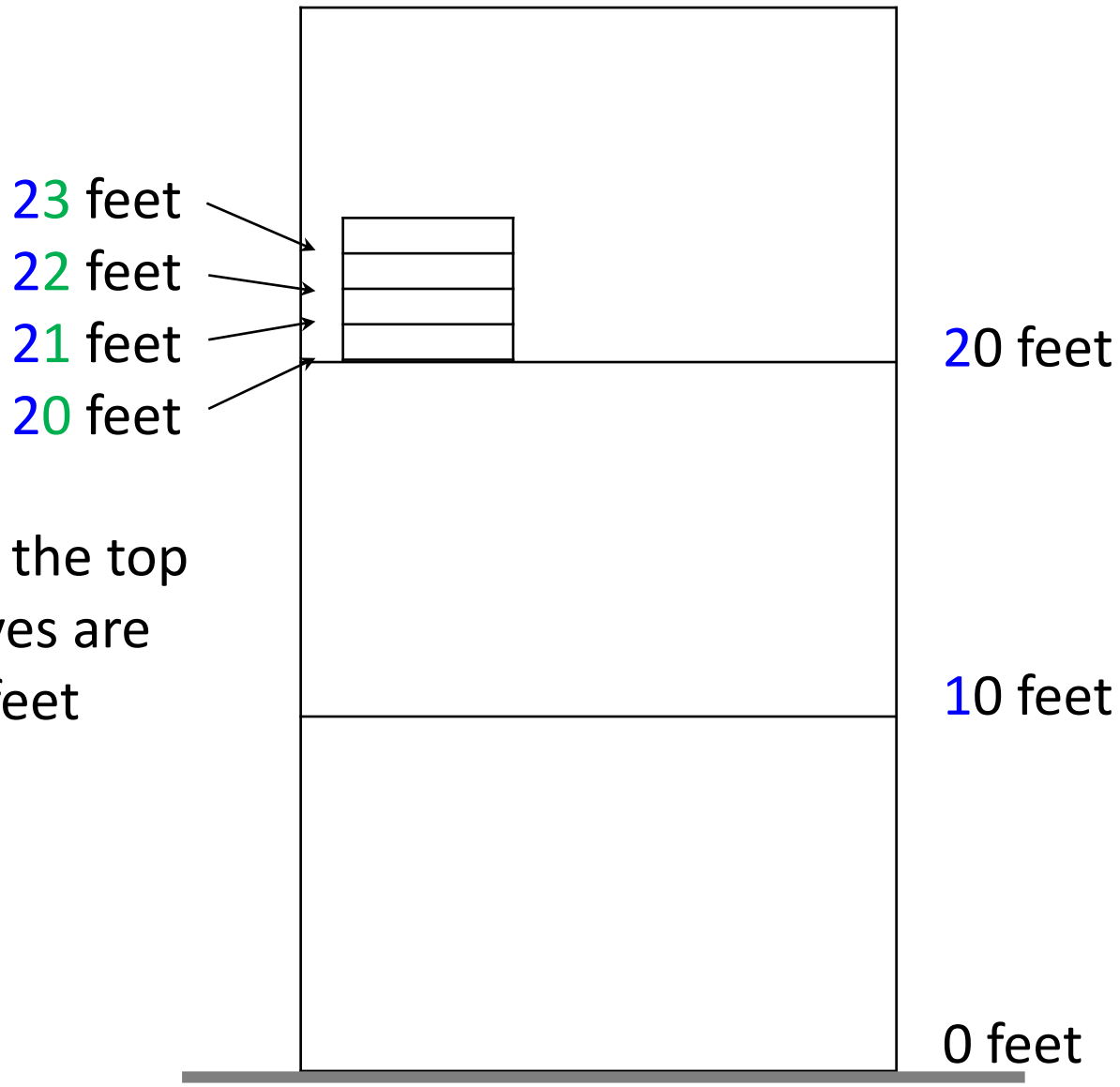
Place the bookcase on the bottom *floor* and the shelves are 0, 1, 2 and 3 feet from the *ground*.



Place bookcase on the middle *floor* and the shelves are 10, 11, 12 and 13 feet from the *ground*.

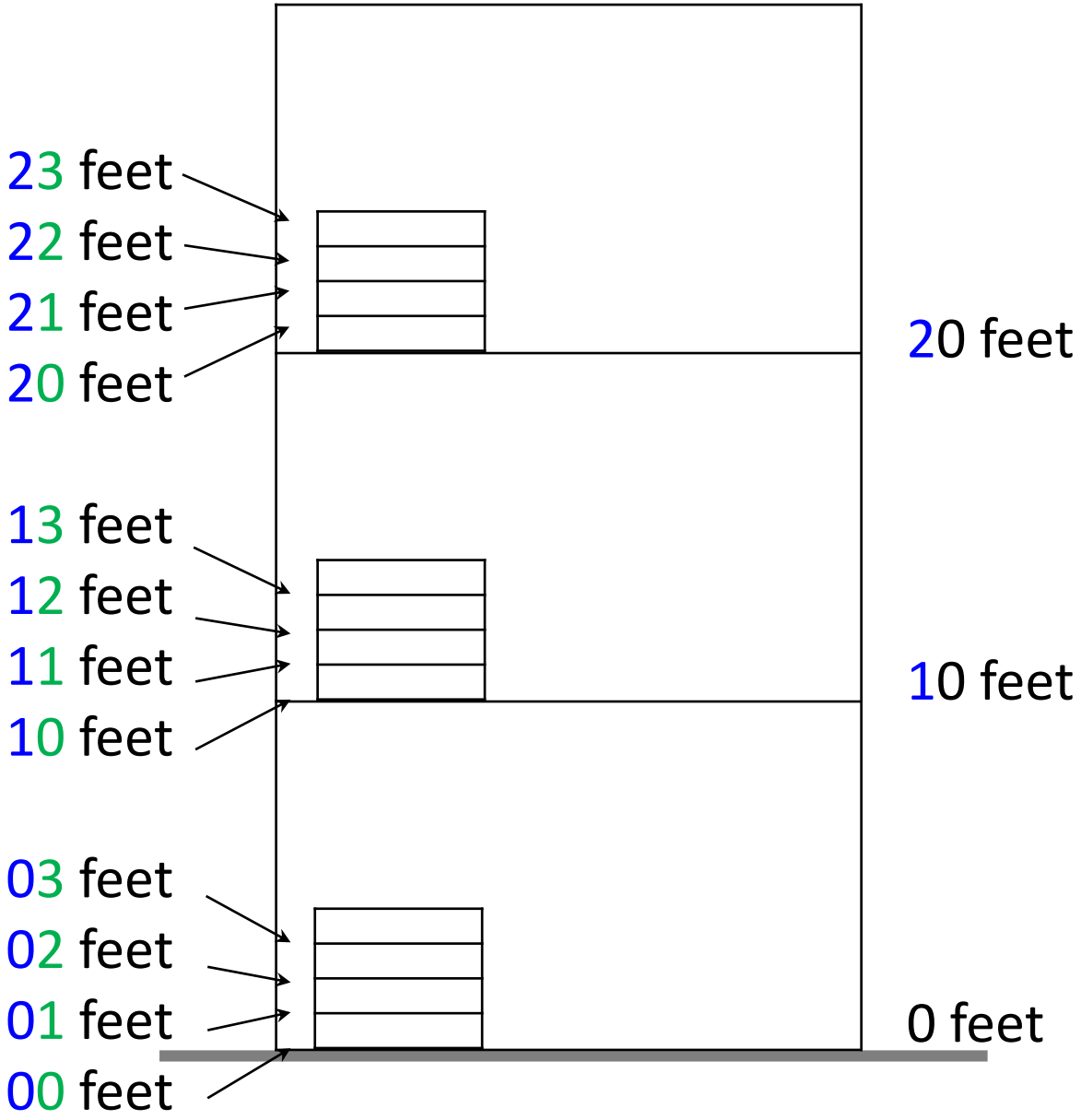


Place bookcase on the top *floor* and the shelves are 20, 21, 22 and 23 feet from the *ground*.



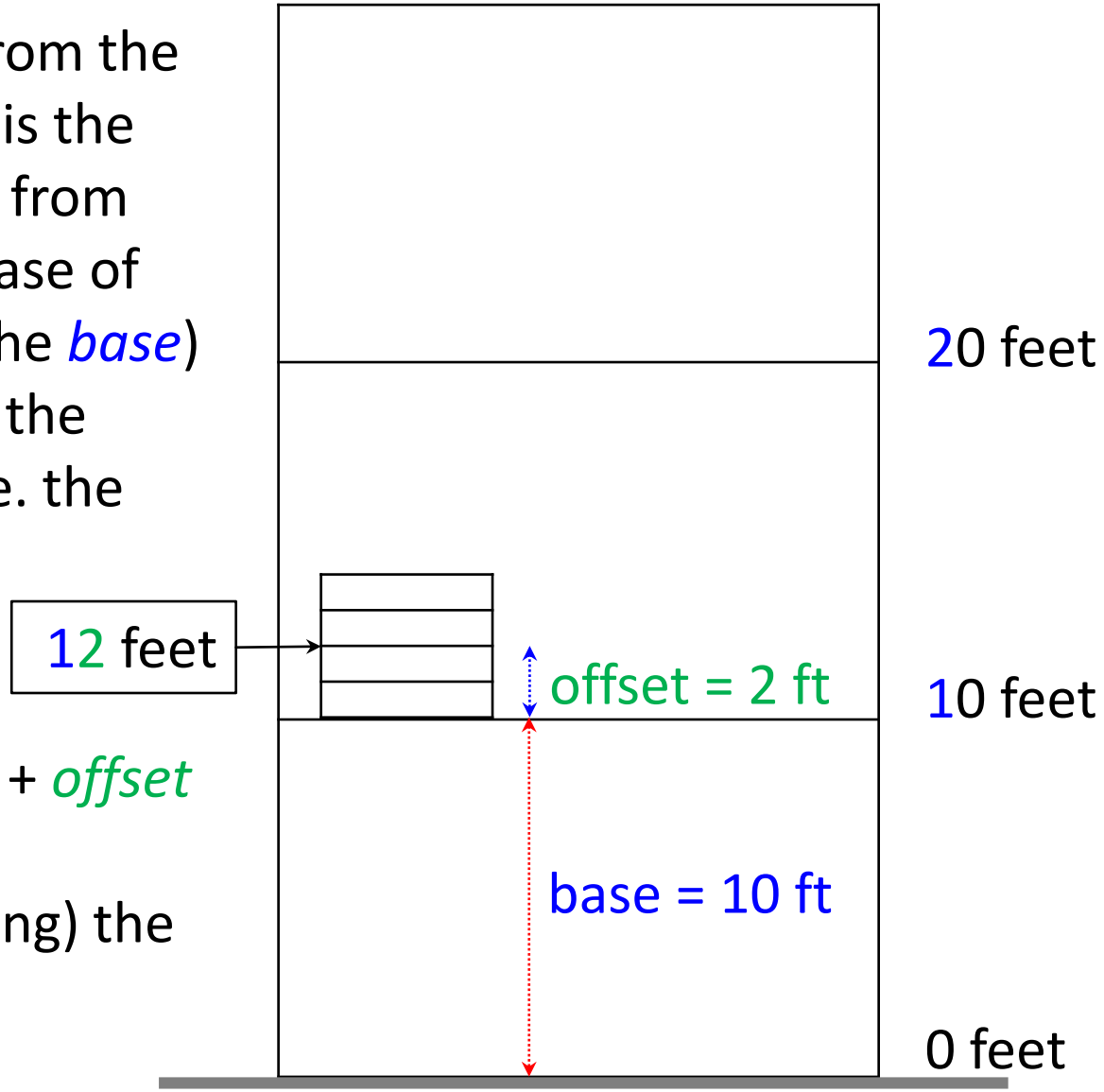
The 1st digit captures *the distance from the floor to the ground* and the 2nd digit captures *the distance from the floor to the shelf.*

Key Point: This method of setting things up makes the computation really easy.



The total distance from the ground to any shelf is the sum of the distance from the ground to the base of the bookshelf (i.e. the *base*) + the distance from the base to the shelf (i.e. the *offset*).

Calculate by adding
distance = *base dist* + *offset*
or in some cases concatenating (joining) the *base* and the *offset*
distance = *12*
base *offset*

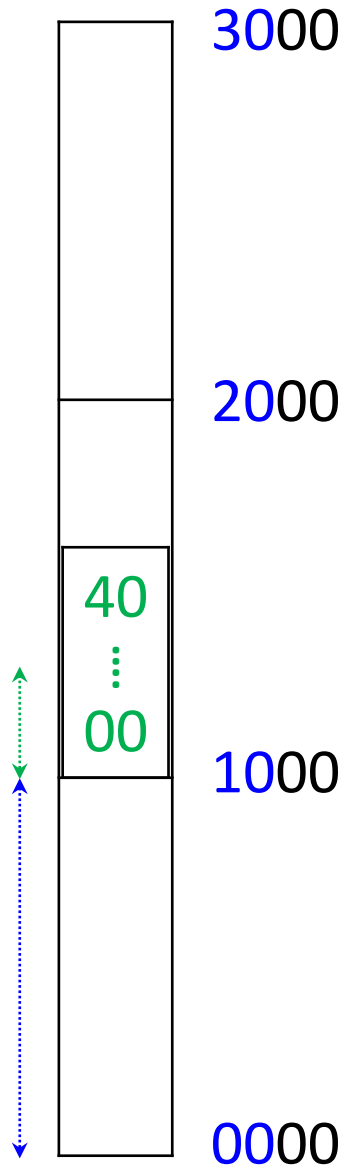


Suppose you had some data that went from 00 to 40 (virtual addresses).

If the kernel placed it in RAM starting at physical address 1000 (the base address) then the physical addresses would go from 1000 to 1040.

To convert from the virtual address to the physical address, just add the base address 1000 (or concatenate 10 to the left).

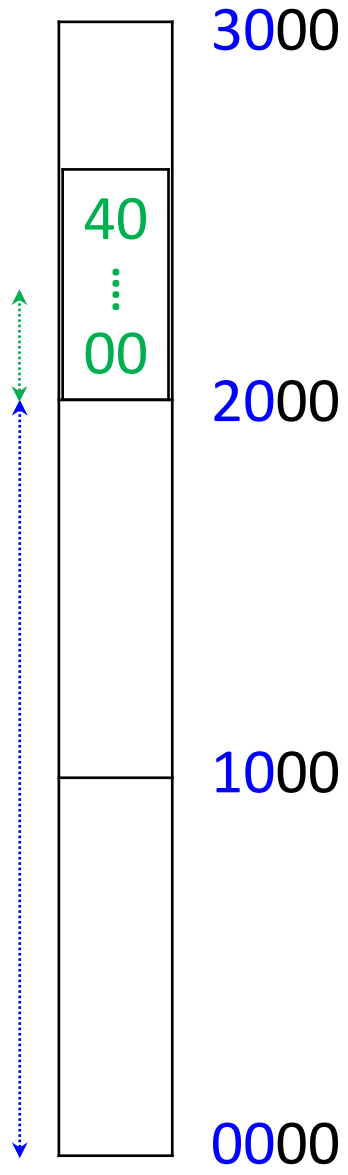
virtual address 10 → physical address 1010
virtual address 20 → physical address 1020
virtual address 30 → physical address 1030
virtual address XY → physical address 10XY



If instead the kernel placed it in a different location, starting at address 2000 (the base address), then the physical addresses would go from 2000 to 2040.

To convert from a virtual address to a physical address, just add the base address 2000 (or concatenate 20 to the left).

virtual address 10 → physical address 2010
virtual address 20 → physical address 2020
virtual address 30 → physical address 2030
virtual address XY → physical address 20XY



Suppose there are two process

1. the green one with base address 1000
2. the red one with base address 2000.

For the red program:

physical addr = 2000 + virtual addr

virtual address 15 → physical address 2015

virtual address XY → physical address 20XY

For the green program:

physical addr = 1000 + virtual addr

virtual address 20 → physical address 1020

virtual address XY → physical address 10XY