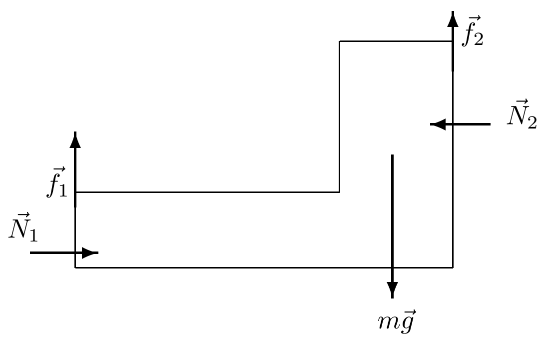
8. (a) The free-body diagram for the person (shown as an L-shaped block) is shown below. The force that she exerts on the rock slabs is not directly shown (since the diagram should only show forces exerted on her), but it is related by Newton's third law) to the normal forces $\vec{N}_1$ and $\vec{N}_2$ exerted horizontally by the slabs onto her shoes and back, respectively. We will show in part (b) that $N_1 = N_2$ so that we there is no ambiguity in saying that the magnitude of her push is N_2. The total upward force due to (maximum) static friction is $\vec{f} = \vec{f}_1 + \vec{f}_2$ where (using Eq. 6-1) $f_1 = \mu_{s1} N_1$ and $f_2 = \mu_{s2} N_2$. The problem gives the values $\mu_{s1} = 1.2$ and $\mu_{s2} = 0.8$.



(b) We apply Newton's second law to the x and y axes (with $+x$ rightward and $+y$ upward and there is no acceleration in either direction).

$$\begin{aligned} N_1 - N_2 &= 0 \\ f_1 + f_2 - mg &= 0 \end{aligned}$$

The first equation tells us that the normal forces are equal $N_1 = N_2 = N$. Consequently, from Eq. 6-1

$$\begin{aligned} f_1 &= \mu_{s1} N \\ f_2 &= \mu_{s2} N \end{aligned}$$

we conclude that

$$f_1 = \left(\frac{\mu_{s1}}{\mu_{s2}}\right) f_2 \ .$$

Therefore, $f_1 + f_2 - mg = 0$ leads to

$$\left(\frac{\mu_{s1}}{\mu_{s2}} + 1\right) f_2 = mg$$

which (with $m = 49$ kg) yields $f_2 = 192$ N. From this we find $N = f_2/\mu_{s2} = 240$ N. This is equal to the magnitude of the push exerted by the rock climber.

(c) From the above calculation, we find $f_1 = \mu_{s1} N = 288$ N which amounts to a fraction

$$\frac{f_1}{W} = \frac{288}{(49)(9.8)} = 0.60$$

or 60% of her weight.