1b) Balancing the forces in the horizontal and vertical directions

$$F_{net,x} = F_s \cos\theta + F_f \cos\theta - F_N \sin\theta = 0$$

$$= F_s \cos\theta + \mu_s F_N \cos\theta - F_N \sin\theta = 0$$

$$\Rightarrow F_N = \frac{-F_s \cos\theta}{\mu_s \cos\theta - \sin\theta}$$

$$F_{net,y} = F_s \sin\theta + F_f \sin\theta + F_N \cos\theta - F_g = 0$$

$$= F_s \sin\theta + F_N (\mu_s \sin\theta + \cos\theta) - mg = 0$$

$$= k s_{min} \left[\sin\theta - \frac{\cos\theta}{\mu_s \cos\theta - \sin\theta} (\mu_s \sin\theta + \cos\theta) \right] - mg = 0$$

$$\Rightarrow \boxed{s_{min} = \frac{mg}{k \left[\sin\theta - \cos\theta \frac{\mu_s \sin\theta + \cos\theta}{\mu_s \cos\theta - \sin\theta} \right]}}$$

2b) Balancing the forces in the horizontal and vertical directions

$$F_{net,x} = F_s \cos\theta - F_N \sin\theta - F_f \cos\theta = 0$$

$$= F_s \cos\theta - F_N \sin\theta - \mu_s F_N \cos\theta = 0$$

$$\Rightarrow \boxed{F_N = \frac{F_s \cos\theta}{\sin\theta + \mu_s \cos\theta}}$$

$$F_{net,y} = F_s \sin\theta + F_N \cos\theta - F_f \sin\theta - mg = 0$$

$$= F_s \sin\theta + F_N (\cos\theta - \mu_s \sin\theta) - mg = 0$$

$$= ks_{max}\left[\sin\theta + \cos\theta \frac{\cos\theta - \mu_s \sin\theta}{\sin\theta + \mu_s \cos\theta}\right] - mg = 0$$

$$\Rightarrow \boxed{s_{max} = \frac{mg}{k\left[\sin\theta + \cos\theta \frac{\cos\theta - \mu_s \sin\theta}{\sin\theta + \mu_s \cos\theta}\right]}}$$