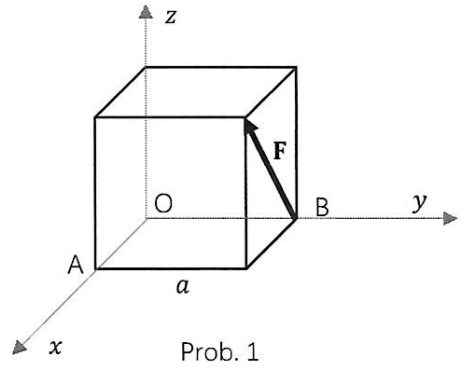
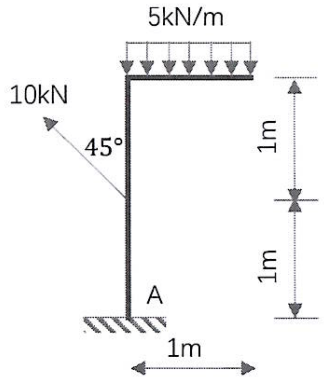
Midterm Exam (Fall 2018)

10:20 – 12:10 (110min), Monday 2018/11/12

1. (15 points) Force **F** is acting on corner B of a cube of edge length a. Calculate the moment vector of the force about point A, and the moment of the force about the x-axis.

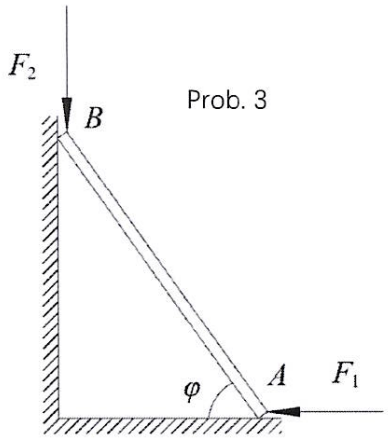


Prob. 1



Prob. 2

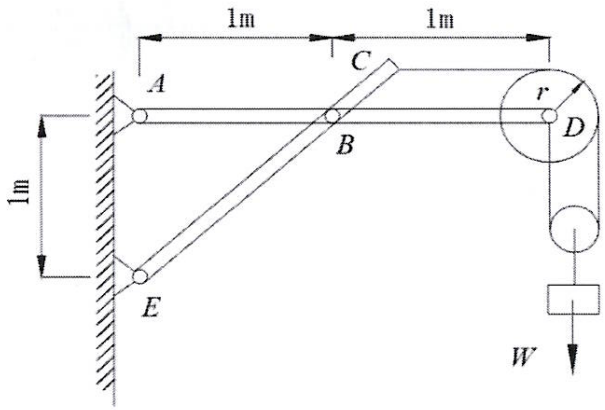
2.(15 points) A force and a distributed load are acting on the L-shaped structural member as shown. Find the equivalent force-couple system at point A.



Prob. 3

3. (15 points) A bar of length l is placed against the wall at an angle φ as shown. Neglect the friction. Use the *principle of virtual work* to identify the relation between forces F_1 and F_2 at equilibrium.

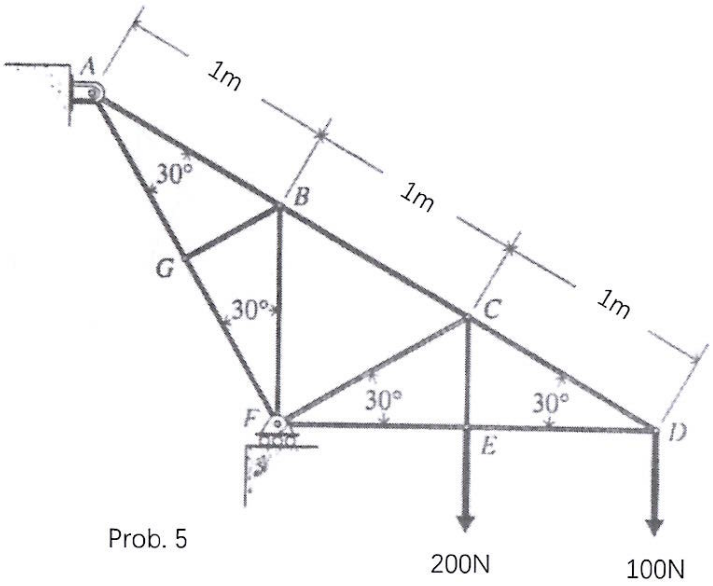
4. (15 points) The hoist pulley structure consisting of two rigid bars, AD and EC, and a frictionless pulley D with radius $r = 15\text{mm}$ is in equilibrium with a weight $W = 1kN$. The structure is assembled with frictionless joints at A, B, E, and D. Neglect the weights of the bars and pulley. Identify the reaction forces from supports A and E.



Prob. 4

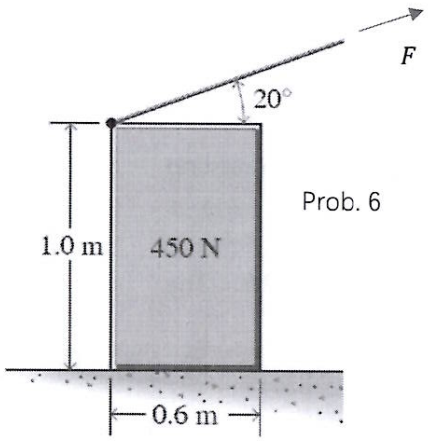
More problems on the back

5. (20 points) Determine the forces in members BC, CF, and EF of the truss shown in the figure. Indicate whether those members are in tension or compression.



Prob. 5

6. (20 points) A rope is attached to the top corner of a 450N block. The coefficient of friction between the block and the floor is 0.3. If the force F is increased to the point of impending motion, determine the magnitude of F and the mode of the impending motion.



Prob. 6