※ 考生請注意：本試題可使用計算機。　　請於答案卷作答，於本試題紙上作答者，不予計分。

1. (10%) Identify the zero-force members in the space truss as shown (2 points will be deducted for each incorrect answer):
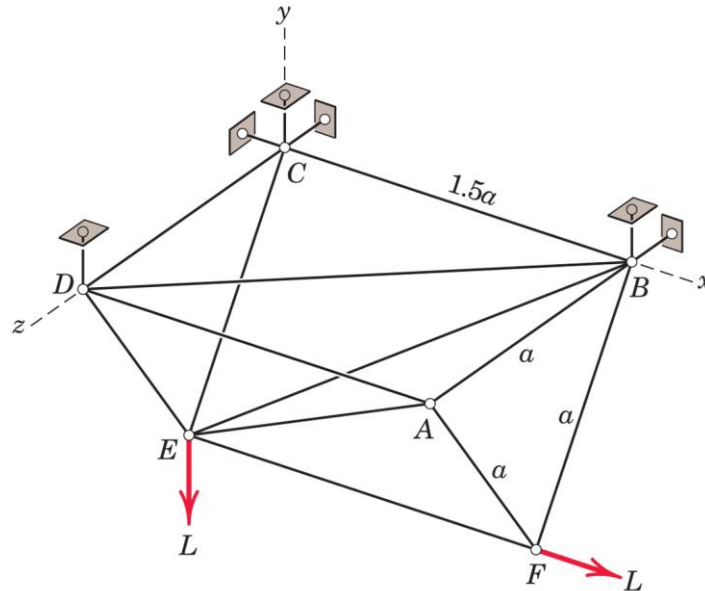

2. Sketch the free body diagrams (FBDs):

(a) (10%) The ice maker as shown contains an ice cube in the shape of a cylindrical segment. The ice weights w with mass center at G. Assuming that the contact between the ice and the supporting surface and the contact between ice and the ejector arm OA are both frictionless, sketch the FBD of the ice.
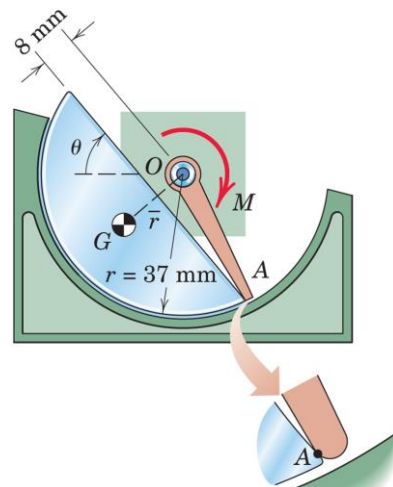
(b) (10%) The motion of the backhoe bucket shown is controlled by the hydraulic cylinders AB and CD. Member BE (complete with hydraulic cylinder CD and bucket-control links DF and DE) weighs w_1 with mass center at G_1. The bucket and its load weigh w_2 with mass center at G_2. Sketch the FBD of the assembly consists of the member BE and the bucket.
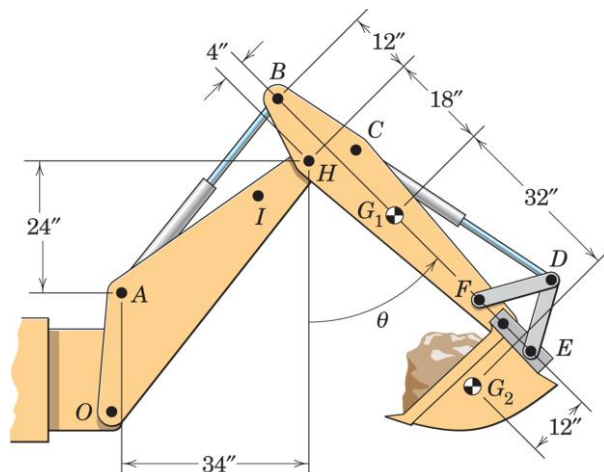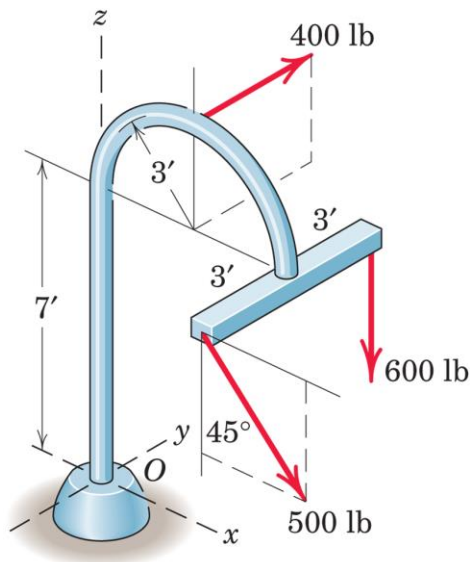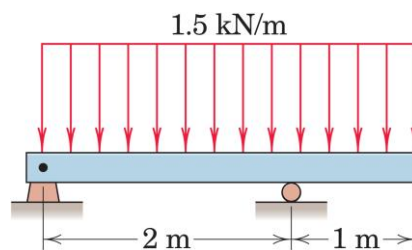
3. For the three forces as shown,

(a) (12%) determine the equivalent resultant force and couple moment acting on the base at O, and

(b) (18%) determine the equivalent wrench resultant the three forces and the point where the axis of the wrench intersects the xz-plane.

4. (20%) Draw the shear force and bending moment diagrams for the beam shown.

5. (20%) <u>By using the principle of virtual work</u> (alternative solution approach is not allowed), determine the moment M necessary to hold the offset slider crank in the position shown against the action of the force P. Neglect the mass of the moving parts.