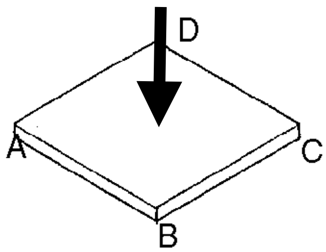
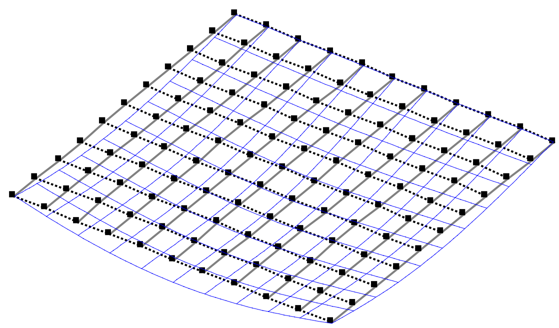
Plates

Problem No. 1
Draw the approximate deflected shape of the plate shown below. The point load acts at the center of the flat plate. The plate is supported on columns at A and B, and on a wall along the CD edge. (Either sketch, or use Multiframe and approximate the plate with a grillage).





Problem No. 2
What is the bending moment capacity per foot of width of a one-way reinforced concrete slab that is 12" thick and has a No. 8 bar every 10"? The compressive strength of concrete is 3 ksi and the steel yield is 40 ksi.

Assume d=10.5"
A_s=0.785 in^2 every 10", or 0.942 in^2 every 12"
T=A_s x f_y=0.942 x 40 = 37.68 kips
C=T, 0.85 x f'_c x a x 12 = 37.68, a=1.23"
M_u=0.9 x 37.68 x (10.5 - 1.23/2) = 335.2 kip-in

Problem No. 3
What is the maximum length that the beam of problem no. 2 can carry its own dead weight? (assume no live load)
w=150lb/ft (unit weight of concrete, 1 ft deep slab)
w=12.5 lb/in

$$M_u = \frac{w \times L^2}{8} \Leftrightarrow L = \sqrt{\frac{8 \times 335{,}200}{1.4 \times 12.5}} = 138 in = 11.5 ft$$

Problem No. 4
Use the cross-beam analogy. What is the load distribution to beams A and B, if the aspect ratio of the slab is 1.4:1? Assume both beams have the same moment of inertia and are made of the same material.

$$\frac{P_A}{P_B} = \left(\frac{L_A}{L_B}\right)^3 \qquad \frac{P_A}{P_B} = 1.4^3 = 2.744$$

Problem No. 5
What is the minimum steel to control temperature changes and shrinkage for a 6" thick slab, reinforced with 40 grade steel? Please give your answer in "no. of bars per length."

A_s= 0.002 x 6 x 12 = 0.144 in^2; **use no. 4 every 16"**, that gives A_s= 0.147 in^2 every 12"