Reinforced Concrete Design
CIE 429 Midterm Examination Fall 1997
Open Book, Notes & other stuff.
No Neighborly Participation

Problem #1: (30 points)
For the frame shown in the sketch

Determine:

a) The deflected shape
b) The moment diagram
c) The shear diagram

Indicate the critical points. There should be no calculations. Indicate moments on the tension side and indicate the shear force pair (sign) for orientation.

Problem #2: (40 points)
Determine the Moment capacity \( M_o \) of the section shown in the sketch.

a) If the reinforcement is 4 #9 bars (The bottom layer of rebar shown).
b) If the reinforcement is 8 #9 bars (Both of the layers of rebar shown).

For both cases, check to see if the section is adequate to the ACI code (ACI 1995)

Parameters:
\( f_c' = 4 \text{ksi} \quad f_y = 60 \text{ksi} \quad k_{max} = 0.75 k_{bal} \quad \rho_{min} = 200/f_y \)
Problem #3 (40 points):
The beam in the sketch is subjected to the shear diagram shown:

a) Determine the shear stress on the cantilever.
b) Determine the shear capacity of the section with or without #3 stirrups
c) Determine the spacing of the stirrups to satisfy all sections of the beam. You must have at least two spacing ranges (s).

Parameters:  \( f_c = 60 \text{ksi} \quad f'_c = 4 \text{ksi} \)

Problem #4 (10 points):
Show in a sketch different types of cracks that may develop in a cantilever beam. Show in an appropriate diagram. No need for text written.

Notes:
1) The total points on the exam are 120. You are given an extra 20 points to account for computational and inadvertent errors. Your grade will be a maximum of 100 even if you score 120. If you score 93, you will get a 93...

2) PLEASE BUDGET YOUR TIME. YOU MAY WANT TO ANSWER THE SHORT ANSWER QUESTIONS FIRST. GOOD LUCK.