1. (20) Find the maximum depth of excavation H before soil at the bottom starts heaving. What is going to be the rate of seepage in the vertical direction for the critical, if the excavation were 20 ft wide and 40 ft long, and a coefficient of permeability of the clay 0.000,005 in/s?
2. (30) Calculate and draw diagrams of distributions of: the total stress, the effective stress and pore water pressure for the soil system presented below.

<table>
<thead>
<tr>
<th>Layer</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLAY</td>
<td>S = 30%</td>
</tr>
<tr>
<td></td>
<td>e = 0.55 G_s = 2.67</td>
</tr>
<tr>
<td>SAND</td>
<td>( \gamma_d = 17.4 \text{ kN/m}^3 )</td>
</tr>
<tr>
<td></td>
<td>e = 0.55</td>
</tr>
</tbody>
</table>

\[ e = 0.55 \]

\[ S = 30\% \]

\[ G_s = 2.67 \]

\[ \gamma_d = 17.4 \text{ kN/m}^3 \]

\[ e = 0.55 \]
3. (25) A new building is going to be constructed next to an existing one. The bottom of the slab of the new building is 6 m above the bottom of strip footings of the existing building. Calculate the increase of the vertical pressure at corner A for the assumption that the new building slab will have a uniformly distributed loading of 120 kPa.
4. (25) Calculate the ultimate settlement of the 3x3 m square foundation presented below for the given loading. (Do not divide the layer into sublayers.)

![Soil Layer Diagram]

- **Sand Layer**
  - Depth: 1 m
  - Density: $\gamma = 19.5$ kN/m$^3$

- **Clay Layer**
  - Depth: 1.5 m
  - Density: $\gamma_{sat} = 19.7$ kN/m$^3$
  - Void Ratio: $e_0 = 0.85$
  - Coefficient of compressibility: $C_c = 1.1$
  - Coefficient of volume compressibility: $C_v = 0.15$
  - Overconsolidation Ratio: OCR = 1.4

- **Rock Layer**
  - Depth: 3.8 m

**Foundation Details**
- Size: 3 m x 3 m
- Load: $F = 1400$ kN