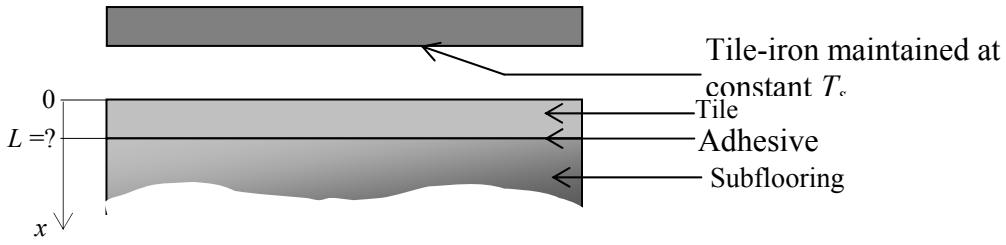
CHG 2314
HEAT TRANSFER

Professor: **B. Kruczek** **2005/03/11**

Assignment No. 7

1. A tile-iron consists of a massive plate maintained at 150°C by an imbedded electrical heater. The iron is placed in contact with a tile to soften the adhesive, allowing the tile to be easily lifted from the subflooring. The adhesive will soften sufficiently if heated above 50°C for at least 2 min, but its temperature should not exceed 90°C to avoid deterioration of the adhesive. Assume the tile and subflooring to have an initial temperature of 25°C and to have equivalent thermophysical properties of k = 0.15 W/m K and ρc = 1.5 x 10^6 J/m^3 K. If there is no contact resistance between the plate of the tile-iron and the tile and $(k\rho c)_{\text{iron plate}} >> (k\rho c)_{\text{tile}}$, what should be the minimum thickness of the tile for which this tile-iron could be utilized without damaging the adhesive? For the calculated minimum thickness, how long would it take to lift the tile using the tile-iron?



Someone suggested that decreasing the temperature of the tile-iron from 150°C to 135°C would result in saving of energy required to lift the tile. Do you agree? Justify your answer numerically.

2. Problem 5.91.

3. A laminar flow of air in a 2 cm-I.D. tube has the following velocity and temperature profiles:

$$u = 0.1\left[1 - \left(r/0.01\right)^2\right] \text{ [m/s]}$$

$$T = 400 - 3\times10^6(1.875\times10^{-5} - 0.25r^2 + 624r^4) \text{ [K]}$$

for r in meters. Determine the Reynolds number (Re_D), the bulk temperature (T_m), the local heat transfer coefficient (h), local Nusselt number (Nu_D), and the local heat flux (q'').

Due Date: **March 18, 2005 at 4:00 p.m. in the assignment box.**