

Assignment 6

Tala El Zein

Question 1

Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with $\epsilon = 0.1$ should you add in order to have the new heat transfer rate to be 1% of the case without shields?

If the values are not equal

$$Q_{\text{from previous example}} = 3625.4$$

$$1\% \text{ of } \dot{Q} = 36.254$$

$$\epsilon = 0.1$$

$$36.253 = \frac{\sigma(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) -}$$

$$\dot{Q}_{N \text{ shields}} = \frac{A\sigma(T_1^4 - T_2^4)}{(N+1)\left(\frac{1}{\epsilon} + \frac{1}{\epsilon} - 1\right)} = \frac{1}{N+1} \dot{Q}_{\text{no shields}}$$

$$1\% \text{ of previous case } \dot{Q} = \frac{1}{100} \times 3625.3 \frac{W}{m^2} = 36.253 \frac{W}{m^2}$$

$$36.253 \frac{W}{m^2} = \frac{5.67 \times 10^{-8} \times (800^4 - 500^4)}{(N+1)\left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)}$$

$$36.253 \frac{W}{m^2} = \frac{19680.57}{(N+1)(19)}$$

$$N+1 = 28.57$$

$$N = 27.57 \sim 28$$

If the values are equal

$$\epsilon_1 = \epsilon_2 = \epsilon_{3.1} = \epsilon_{3.2} = 0.1$$

$$T_1 = 800 \text{ K}$$

$$T_2 = 500 \text{ K}$$

$$\frac{Q}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\left(\frac{1}{\epsilon} + \frac{1}{\epsilon} - 1\right)} \frac{Q}{A} = \frac{5.67 \times 10^{-8} \times (800^4 - 500^4)}{\left(\frac{1}{0.1} + \frac{1}{0.1} - 1\right)} = 1035.81 \text{ W/m}^2$$

$$1035.81 \times 1\% = 10.35$$

$$\frac{\sigma(T_1^4 - T_2^4)}{(N+1)\left(\frac{1}{\varepsilon} + \frac{1}{\varepsilon} - 1\right)} = \frac{1}{N+1}$$

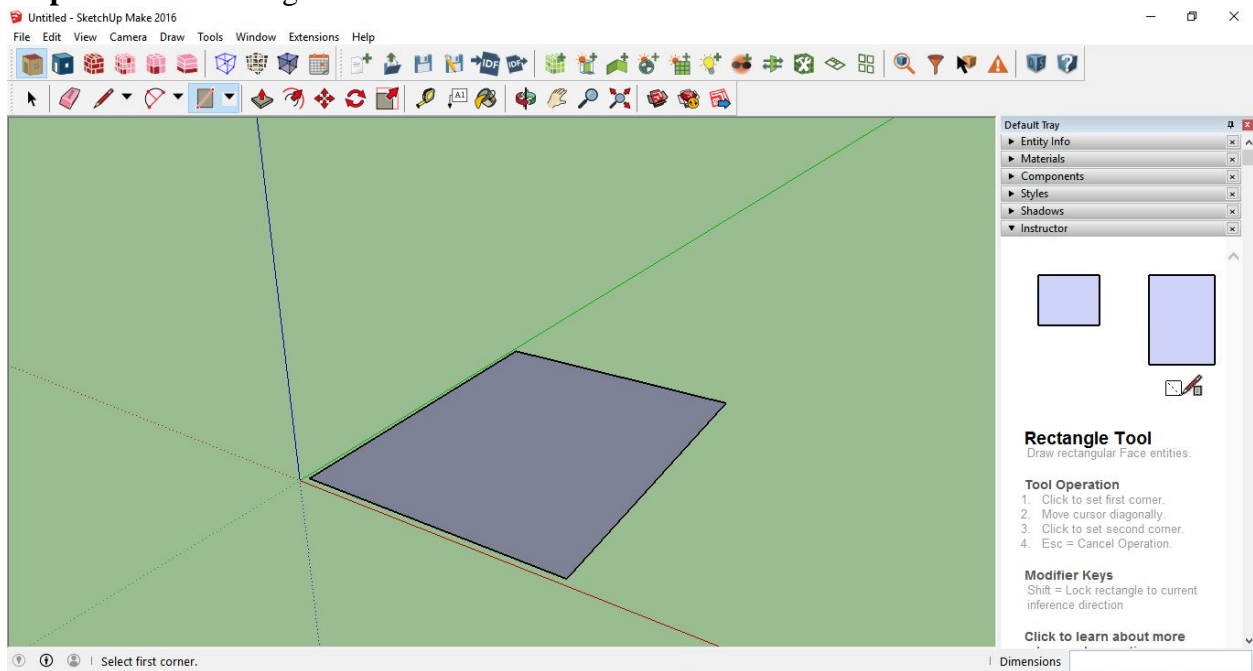
$$\frac{1}{(N+1)}Q = \frac{1}{100}Q$$

99 SURFACES TO LOWER THE RADIATION 1 %

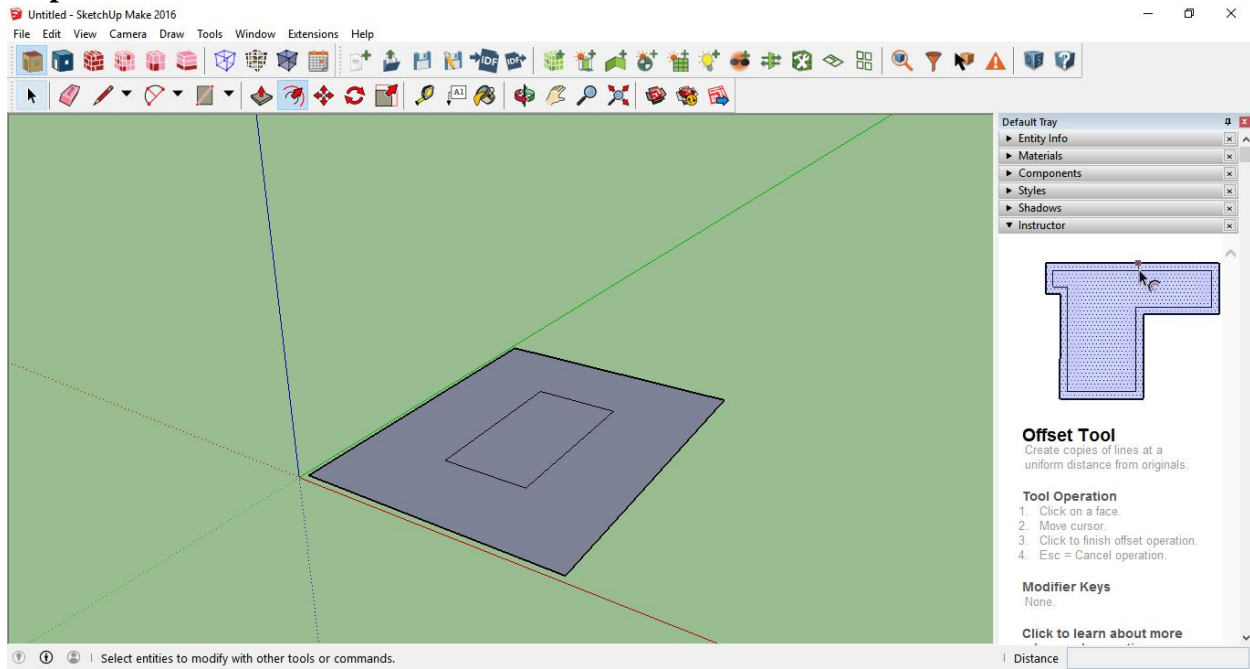
Question 2

You should create a pdf file with screenshots of all of the steps we went through and explain briefly the reason behind the use of each step.

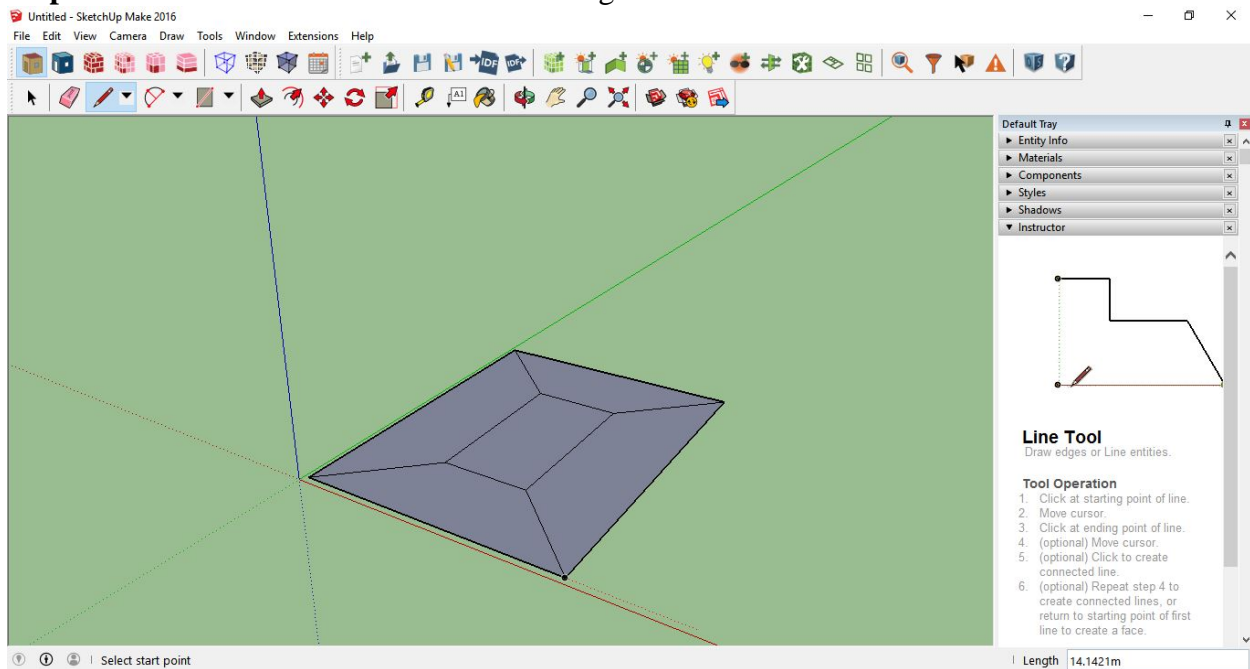
Step 1: draw a rectangle 40*30



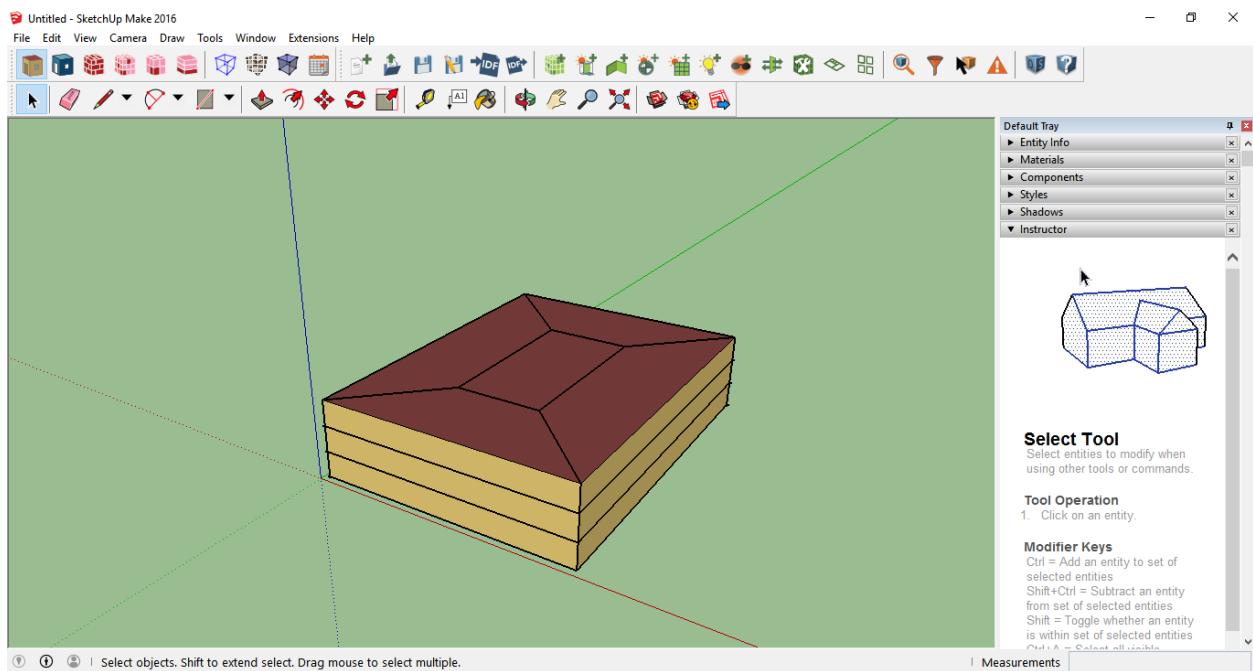
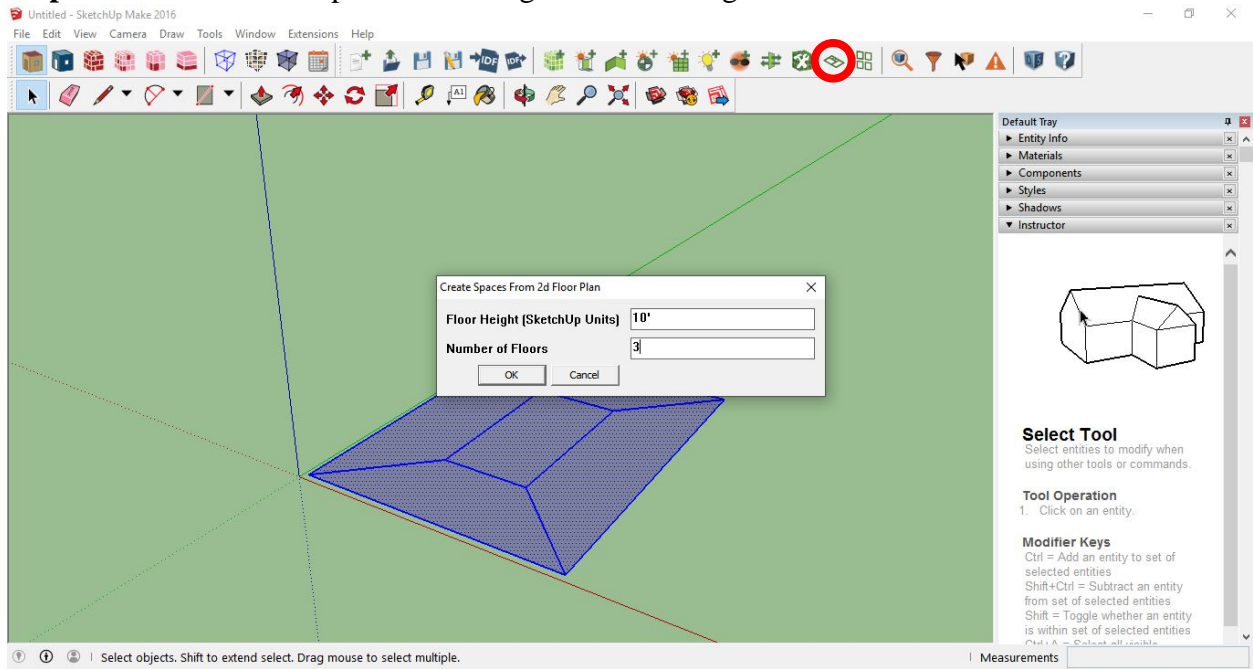
Step 2: offset 10 towards the center



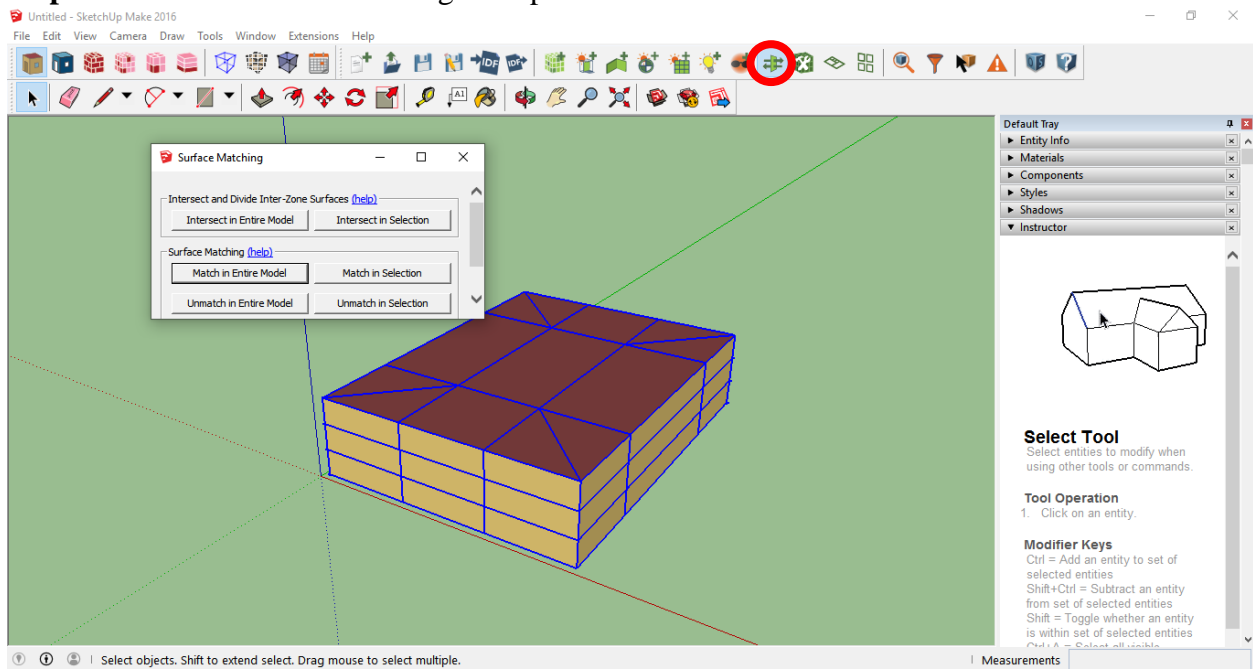
Step 3: connect the corners to the inner rectangle



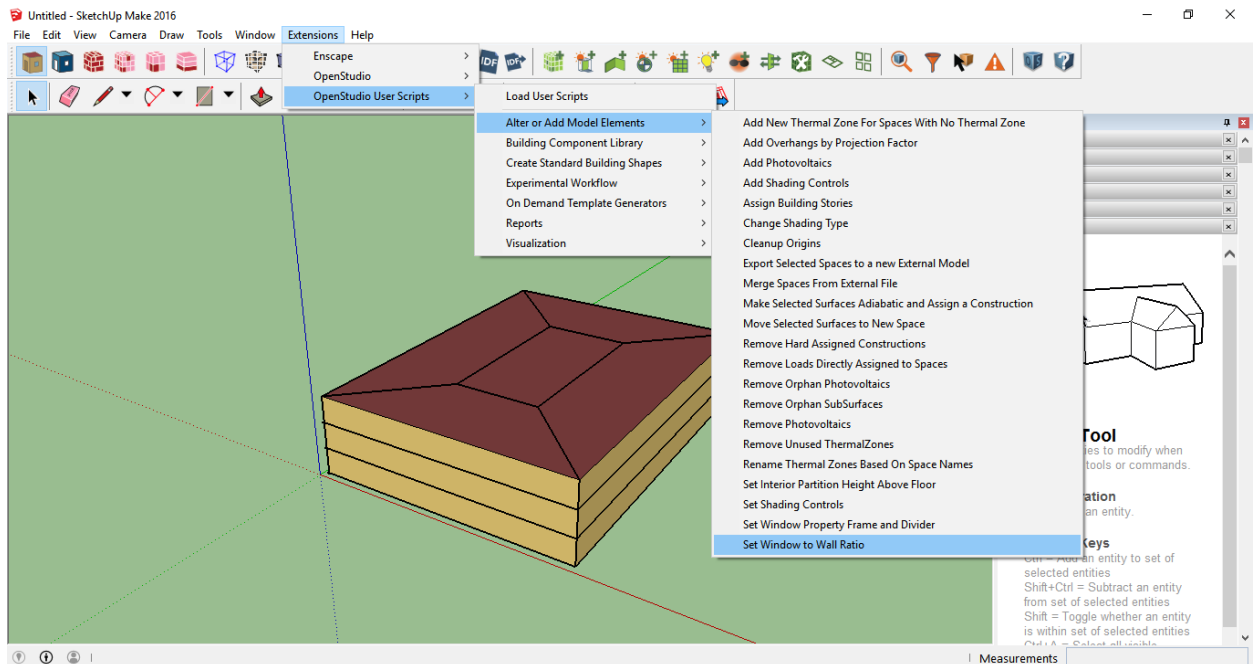
Step 4: click on “create spaces from diagrams” and assign 3 to the number of floors.

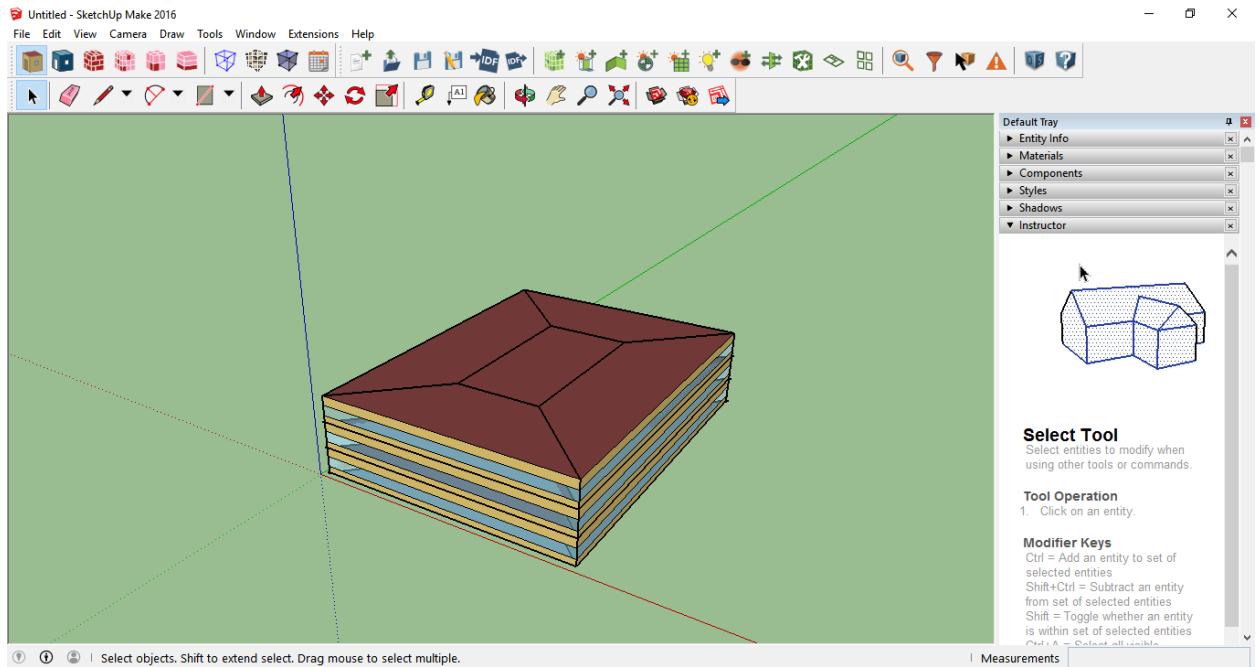
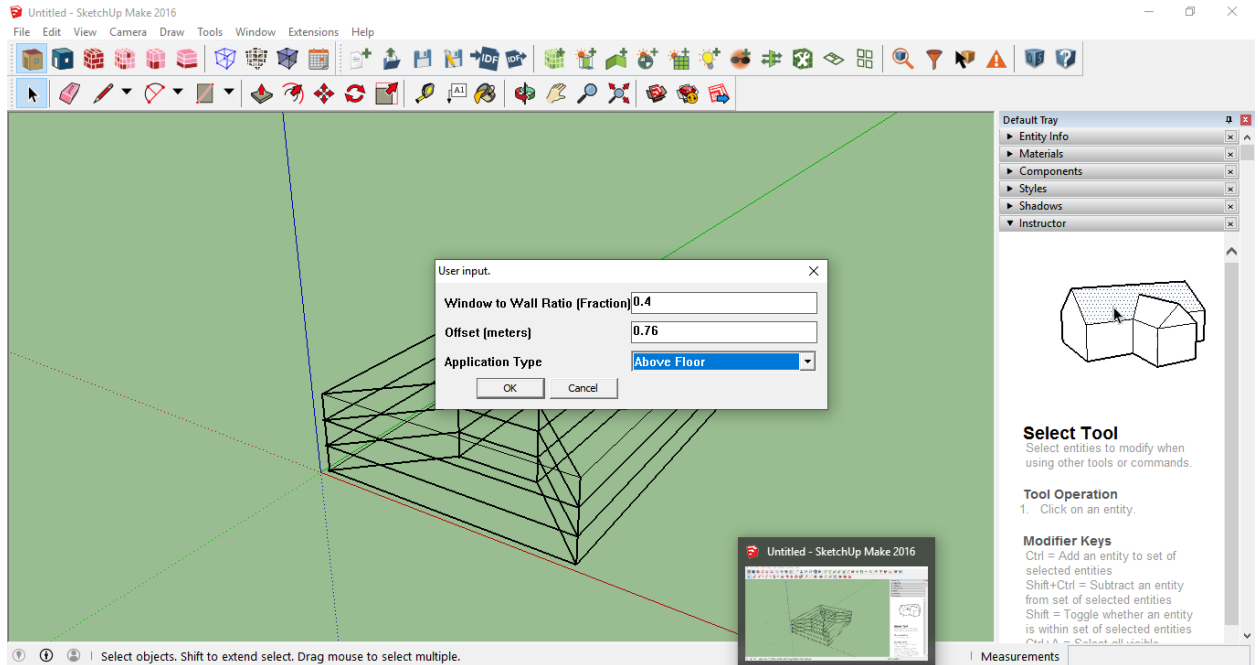


Step 5: click on “surface matching” and press “match in entire model”

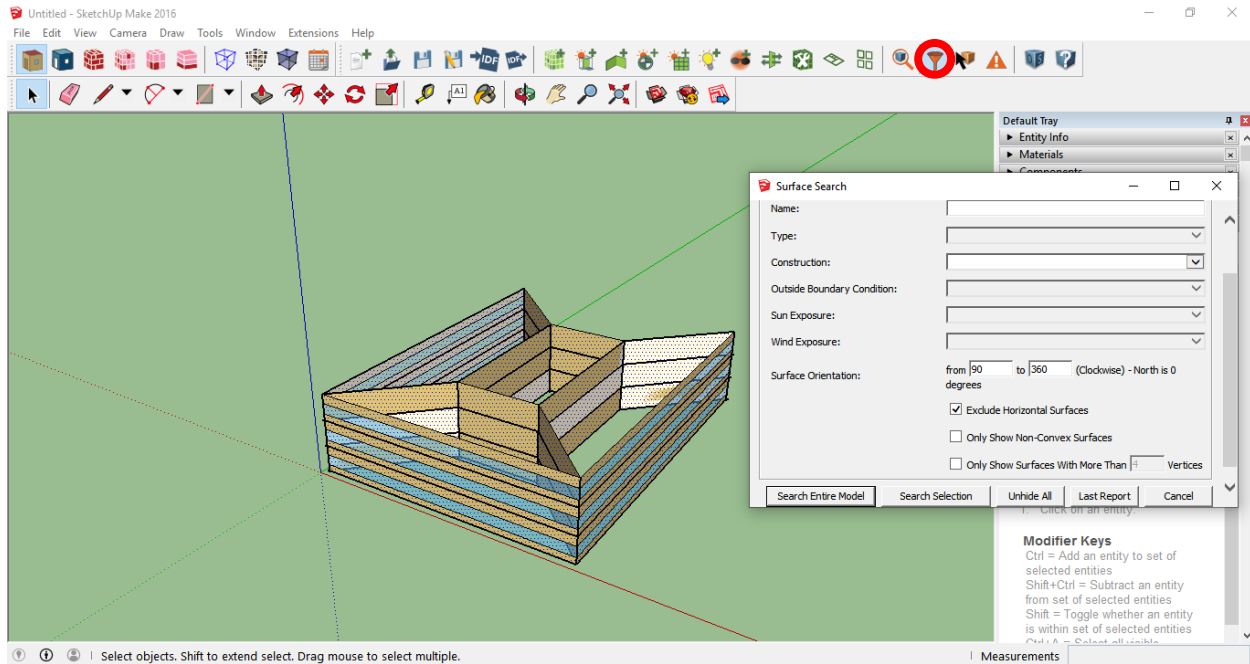


Step 6: go to extensions – openstudio user scripts – alter or add model elements – set window to wall ratio

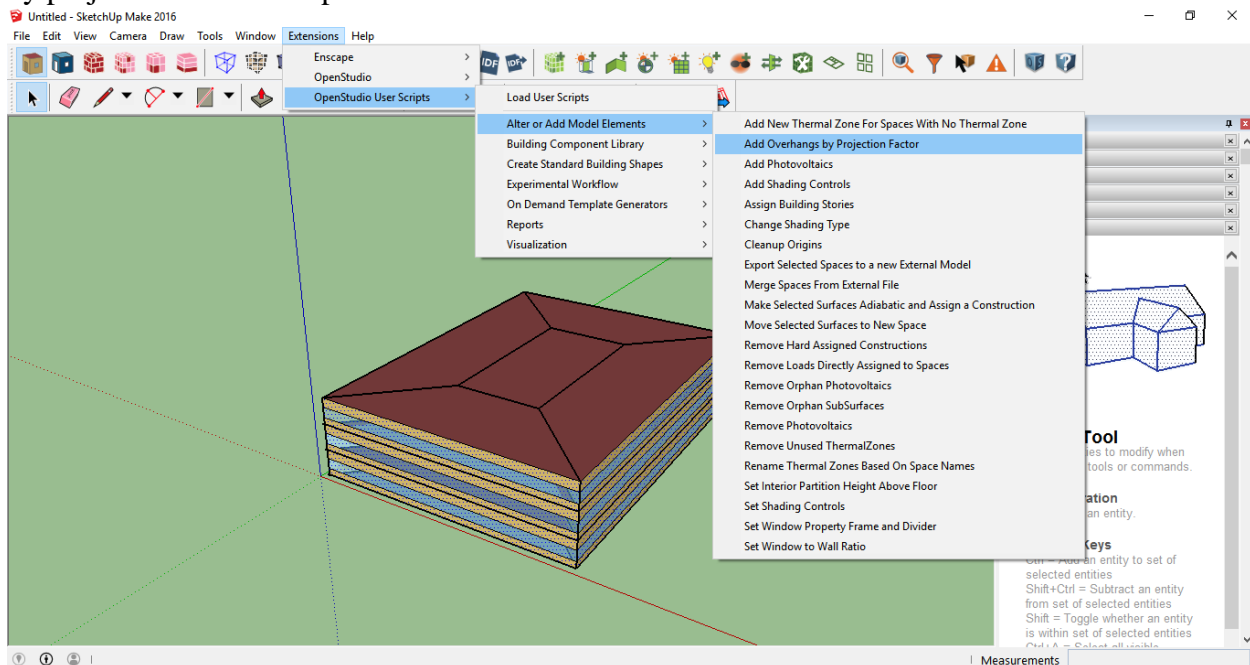


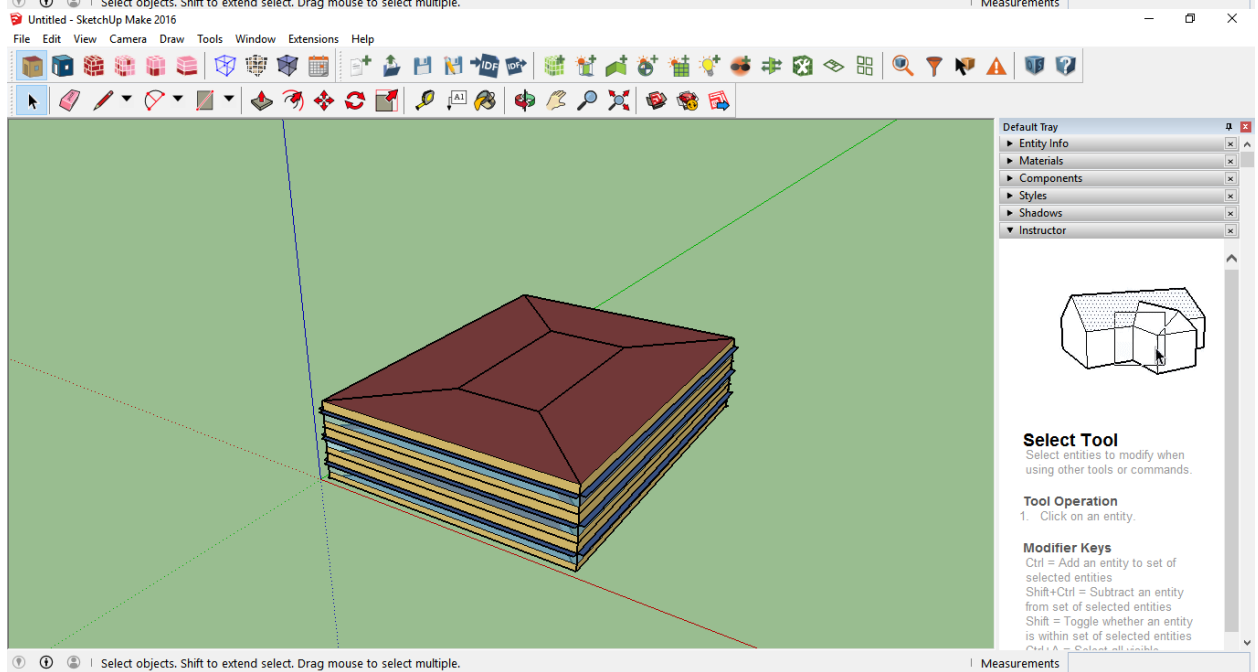
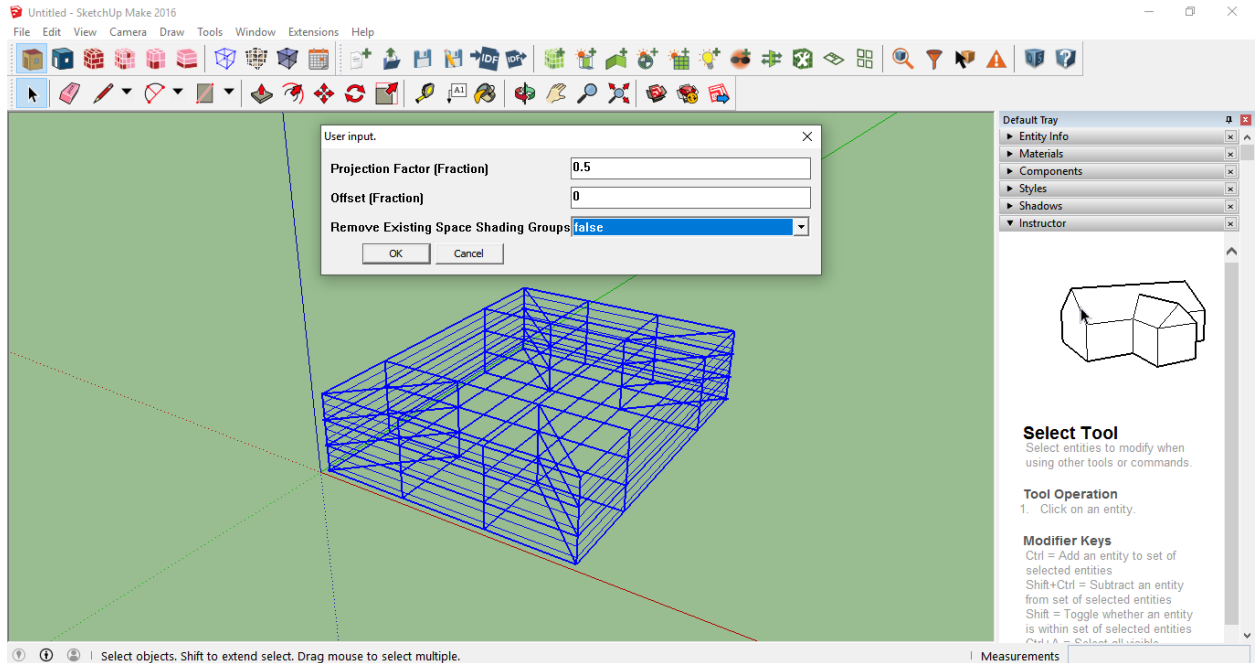


Step 7: press “search surfaces” and assign 90 to 360 in the surface orientation then click on search entire model

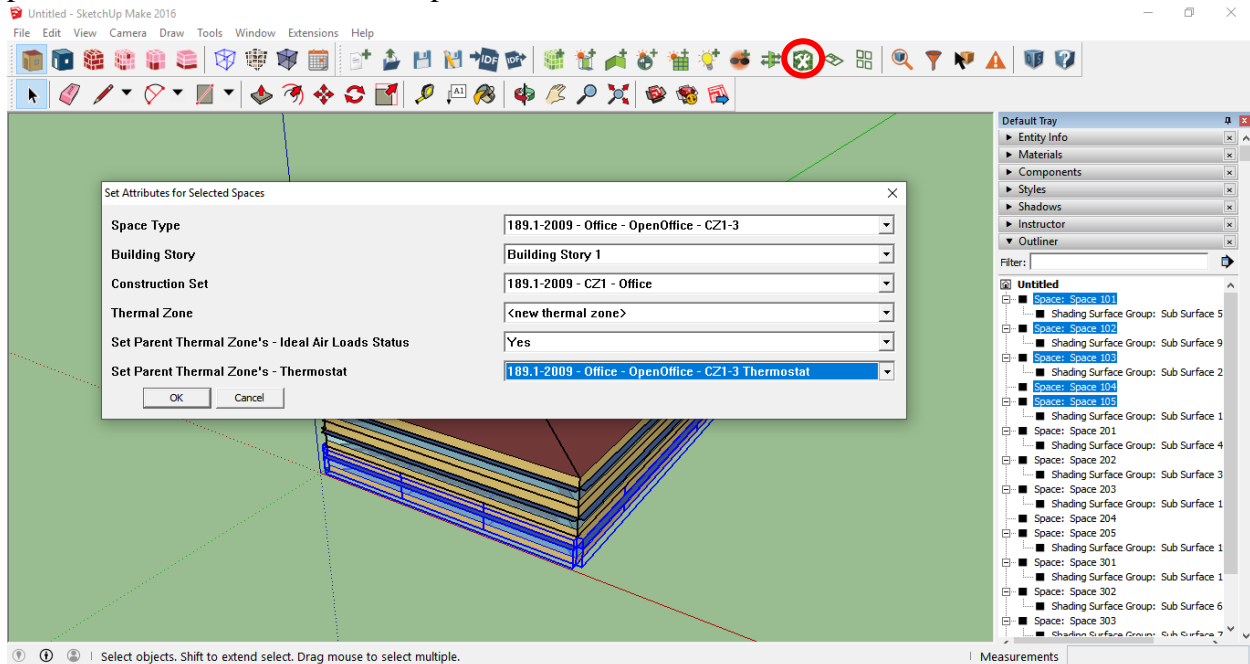


Step 8: go to extensions – openstudio user scripts – alter or add model elements – add overhangs by projection factor and press “ok” then save the file

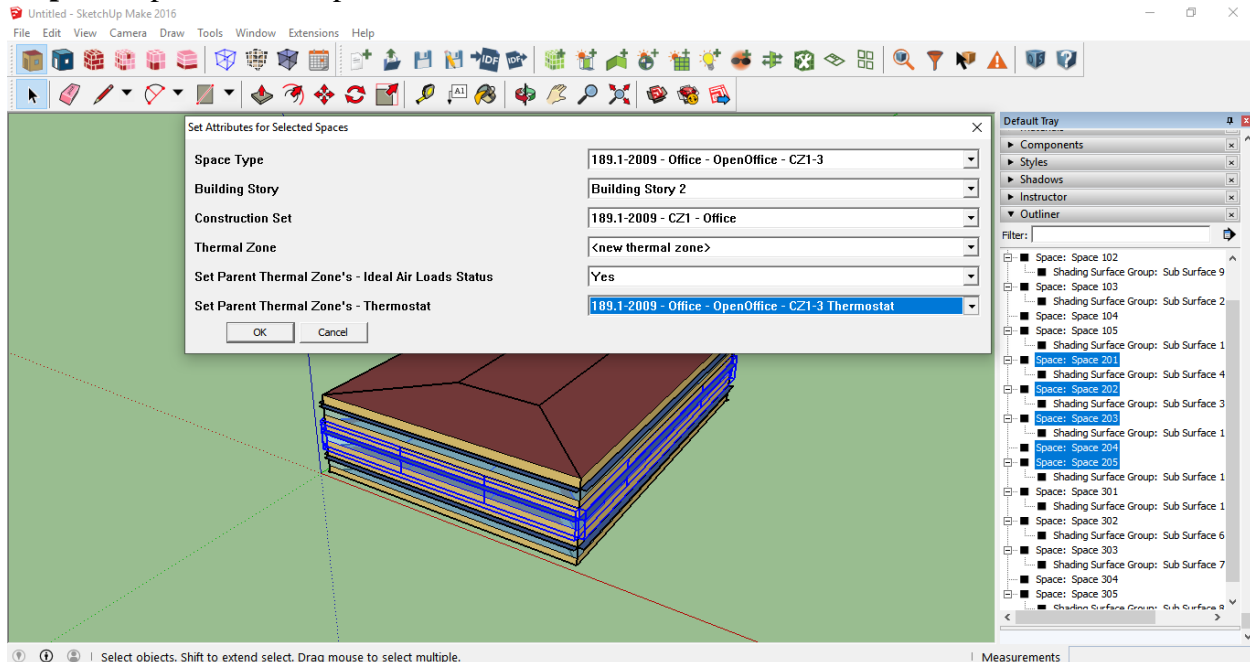




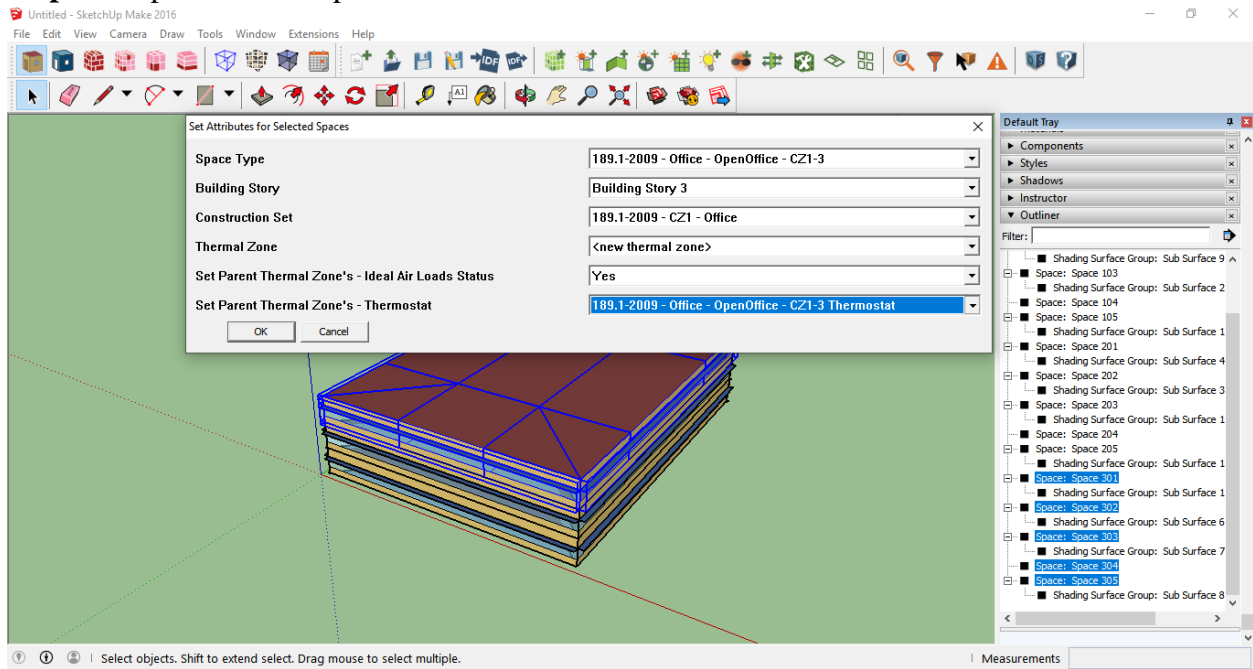
Step 9: select items 101 to 105 the go to “set attributes for selected spaces” and change the parameters as shown below then press “ok”



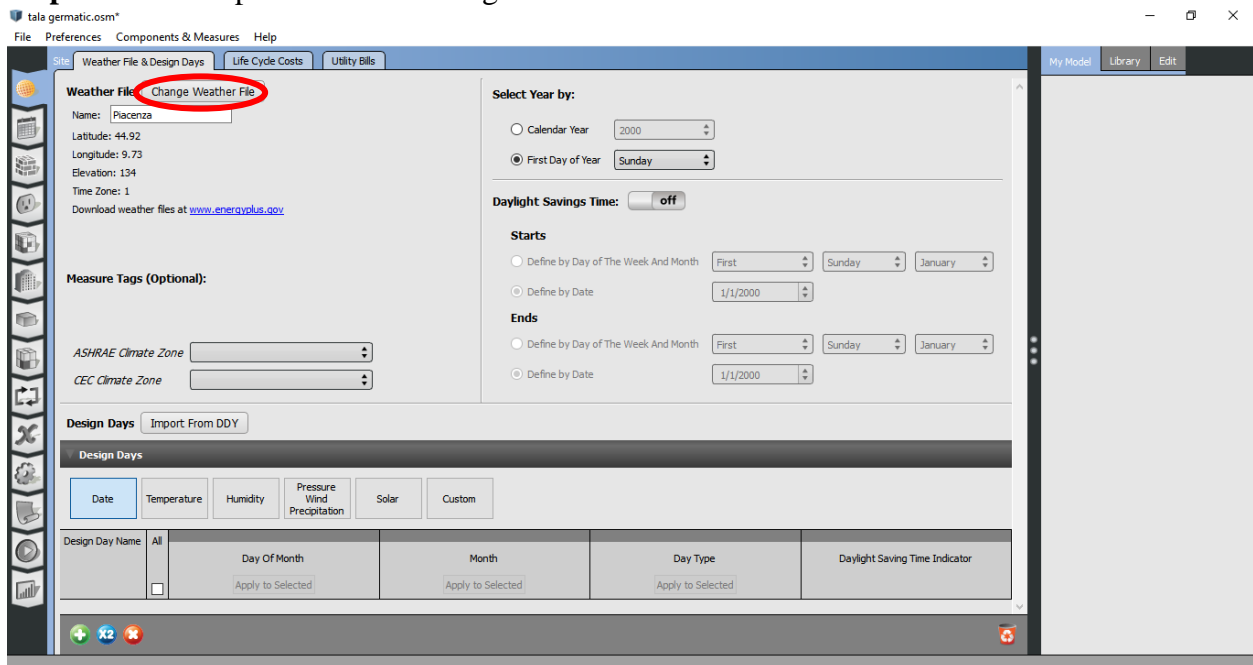
Step 10: repeat the same procedure from 201 to 205



Step 11: repeat the same procedure from 301 to 305



Step 12: launch openstudio and change the weather data to Piacenza.



Step 13: go to “run simulation” and click run.

