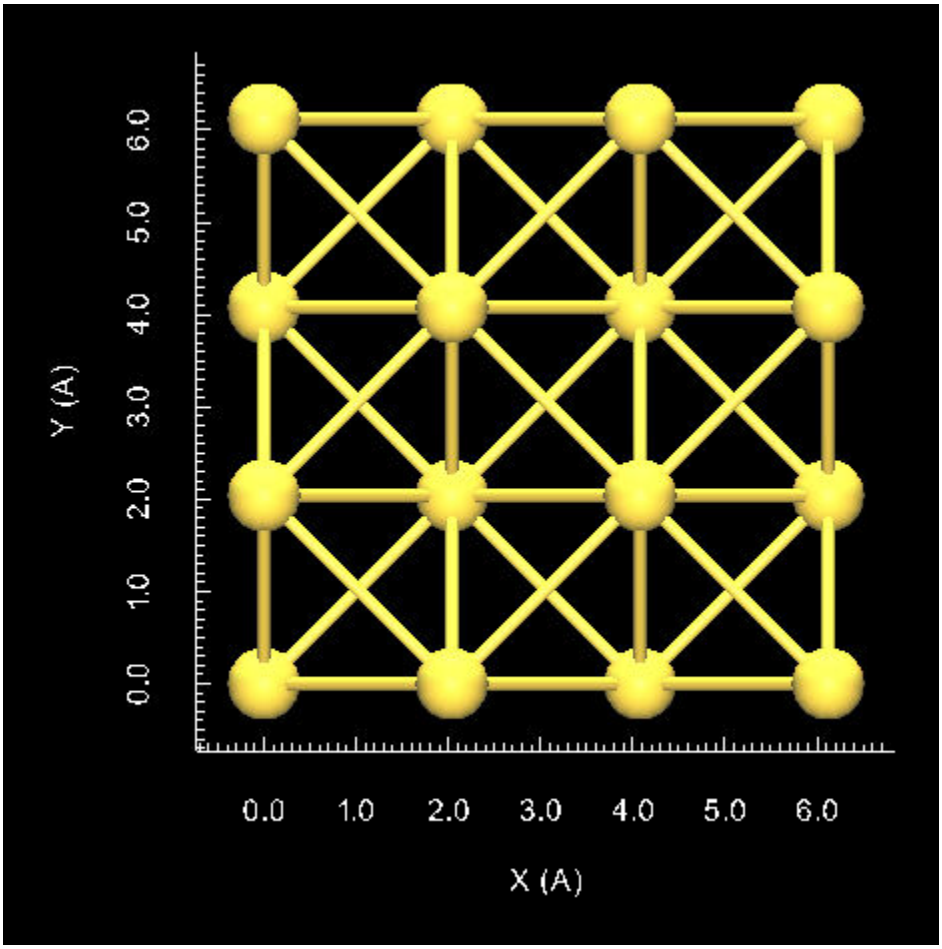
ECE 305- Spring 2018

Homework 1 solution

1.a) (001) surface of FCC gold is the x-y plane of the lattice.



b) Any row below is acceptable:

x-spacing (Å)	y-spacing(Å)	z-spacing(Å)
2	2	0
2	0	2
0	2	2

c) Nearest neighbor spacing=$1.02 \cdot \sqrt{2^2 + 2^2 + 0}$=$2 \cdot 1.02 \cdot \sqrt{2}$ Å (1.02 introduced to correct for rounding error of the spacings to 2 Å)

d) Radius of atom=$2 \cdot 1.02 \cdot \sqrt{2}$ Å/2=$1.02 \cdot \sqrt{2}$ Å

Volume of atom=$\frac{4}{3}\pi(1.02 \cdot \sqrt{2})^{3}$ Å^3

Number of atoms in FCC lattice unit cell=4

Total volume occupied by atoms in the unit cell=$\frac{16}{3}\pi(1.02 \cdot \sqrt{2})^{3}$ Å^3

Total volume of the unit cell=4.08^3 Å^3 (clarification: The built in Au FCC lattice in the tool is used. Lattice built using 3.61 Å is also fine.)

Fraction of volume occupied by atoms=$\frac{\frac{16}{3}\pi(1.02 \cdot \sqrt{2})^{3}}{4.08^3} \approx 74\%$

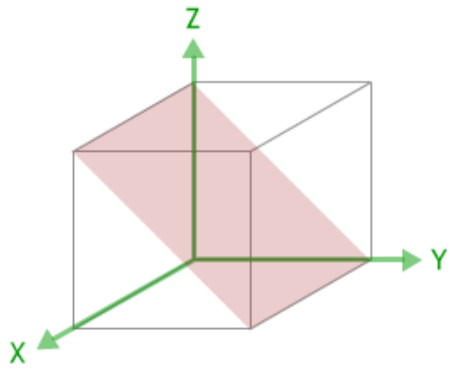
Note: Similar answers are expected when lattice is drawn using 3.61 Å as the lattice constant.

2. a. (100)

b. $(21\bar{1})$

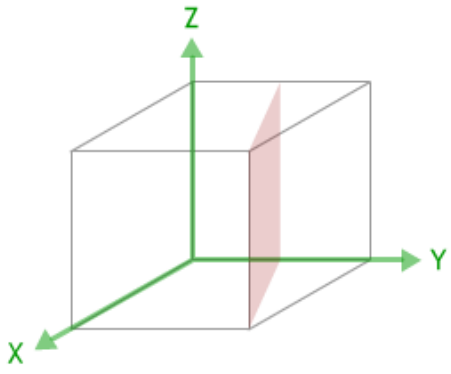
c. (312)

3. a.



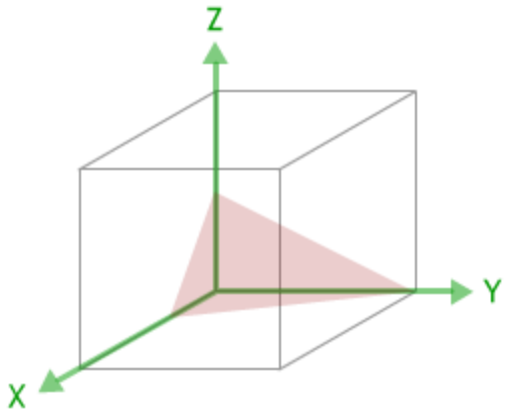
(0 1 1)

b.



$(1\bar{2}0)$

c.



(3 1 2)