1. Suppose the fraction of undergraduate students who smoke is 15% and the fraction of graduate students who smoke is 23%. If one-fifth of the college students are graduate students and the rest are undergraduates, what is the probability that a student who smokes is a graduate student?

P(S|UG) = 0.15

P(S|G) = 0.23

P(G)=1/5 =0.2

P(UG)=4/5 =0.8

According to Bayes’ Theorem,

Probability of Graduate student who smokes

P(G|S)

= P(S|G) \* P(G) / P(S|UG) \*P(UG) + P(S|G) \* P(G)

0.23 \* 0.2

= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

0.15 \* 0.8 + 0.23 \* 0.2

= 0.046 / 0.12 + 0.046

= 0.046 / 0.166

= 0.277

(b)  Given the information in part (a), is a randomly chosen college student more likely to be a graduate or undergraduate student?

P(UG) > P(G)

So randomly chosen college student is likely to be a undergraduate student

(c)  Repeat part (b) assuming that the student is a smoker.

Probability of graduate student who smoke

= P(G|S)

= 0.277 (a – part)

Therefore, Probability of Under graduate student who smoke

= P(UG | S) = 1 - P(G|S)

= 1 – 0.277

= 0.723

**P (UG | S) > P(G|S)**

Therefore, randomly chosen college student who smoke is likely to be a undergraduate student.

(d)  Suppose 30% of the graduate students live in a dorm but only 10% of the undergraduate students live in a dorm. If a student smokes and lives in the dorm, is he or she more likely to be a graduate or undergraduate student? You can assume independence between students who live in a dorm and those who smoke.

P(D|G) = 0.3

P(D|UG) = 0.1

P(S|G) = 0.23

P(S|UG) = 0.15

P(G)=1/5 =0.2

P(UG)=4/5 =0.8

Dorm and Smoke are independent

P (D, S |G) = 0.3 \* 0.23 = 0.069

P (D, S|UG) = 0.1 \* 0.15 = 0.015

P (UG | D, S)

P (D, S|UG) \* P(UG)

= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P (D, S|UG) \* P(UG) + P (D, S|G) \* P(G)

= 0.015 \* 0.8 / {P (D, S|UG) \* P(UG) + P (D, S|G) \* P(G)}

= ***0.012 / {P (D, S|UG) \* P(UG) + P (D, S|G) \* P(G)}***

P (G | D, S)

P (D, S|G) \* P(G)

= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P (D, S|UG) \* P(UG) + P (D, S|G) \* P(G)

= 0.069 \* 0.2 / {P (D, S|UG) \* P(UG) + P (D, S|G) \* P(G)}

=***0.0138 / {P (D, S|UG) \* P(UG) + P (D, S|G) \* P(G)}***

Therefore, P (UG | D, S) < P (G | D, S)

If a student smokes and lives in the dorm, is he or she more likely to be a graduate student