Problem 1

Given: X = {0:20} … discrete random variable, non-uniform distribution. Pr(X <= 17) = 0.2 Pr(X <= 18) = 0.3 Pr(X <= 19) = 0.35

The complements of this data: Pr(X > 17) = 1 - Pr(X <= 17) = 0.8 Pr(X > 18) = 1 - Pr(X <= 18) = 0.7 Pr(X > 19) = 1 - Pr(X <= 19) = 0.65

A.

Pr(X > 19) = 0.65 (as X can only be the number 20)

B.

Pr(X >= 19) = Pr(X > 18) = 0.7 This make sense because X can only be 19 or 20 We already know thee probability of being <= 18 is 0.3 Thus what is left must add up to 1.0

C.

Pr(X < 19) … probability of X being between 0 to 18, inclusive of 18 = Pr(X <= 18) = 0.3

D.

Pr(18 <= X <= 19) … this means X can be either 18 or 19

Possible probability windows for X: Pr(X <= 17) = 0.2 Pr(X > 19) = 0.65

The only remaining sample space left is 18 and 19 The sum of the probabilities has to be = 1

Pr(18 <= X <= 19) = 1 - Pr(X <= 17) - Pr(X > 19) = 1 - 0.2 - 0.65 = 0.15

Problem 2

9.8% of 18-24 year olds = left handed… this is binomial random variable

P(X <= 2) is the question (since it is “<= 2 individuals”)

Population = 18-24 year odls n = 10 p = 0.098 k = {0 - 2} # This satisfies the “at most two individuals” comment nCk = n! / k!(n-k)! P(X = k) = nCk x p^k x (1-p)^(n-k)

X ~ B(10, 0.098)

```
P(X = 2) = [10C2] x 0.098^2 x (0.902)^(8)
nCk = 10! / 2!(8)! = 10 * 9 / 2 = 45
P(X = 2) = 45 x 0.009604 x 0.43818 = 0.1894

P(X = 1) = [10C1] x 0.098^1 x (0.902)^(9)
nCk = 10! / 1!(9)!
P(X = 1) = 10 x 0.098 x 0.3952 = 0.3873

P(X = 0) = [10C0] x 0.098^0 x (0.902)^(10)
nCk = 10! / 0!(10)!
P(X = 0) = 1 x 1 x = 0.3565
```

Cumulative probability, thus needs additions P(X <= 2) = 0.9332

Problem 3

A. Probability of getting flu is 0.01 with vaccine. Number of trials is 100. Yes, this could be a binomial variable (either get the flu, or not).

B. Population of 10. Selecting 5 kids total, but no replacement. They answer a question correctly or not is a binary, however each student has a different probability of answering the question correctly (e.g. could have studied, could have cheated, etc). Thus, the success of each trial is not the same.

Problem 4

Probability of test of being positive for HIV is 0.005 Population is 140 people Test can be positive or not, with same chance each trial

A.

X ~ B(140, 0.005)… justified above why this is a binomial random variable

B.

Pr(X > 0) = 1 - Pr(X <= 0)

Since there can't be negative people… Pr(X <= 0) = Pr(X = 0)

n = 140 p = 0.005 k = 0 nCk = 140! / 0!(140-0)! = 140!/140! = 1

P(X = 0) = nCk x p^k x (1-p)^(n-k) = 140C0 x 0.005^0 x (0.995)^(140) = 1 x 1 x 0.4957 = 0.4957

Pr(X > 0) = 1 - 0.4957 = 0.5043