Sampling: Final Exam
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1.

2.

3. (a) In the first table, all of the possible samples are shown, along with the probability of drawing each sample (found with replacement). The inclusion probabilities for units I, II, III, IV, V, and VI are shown in the table on the right. The R code for computing these values are shown below.

Sample	Units	$P(S = s)$
1	1,2	0.04889
2	1,3	0.07334
3	1,4	0.01497
4	1,5	0.01834
5	1,6	0.03056
6	2,3	0.05867
7	2,4	0.01198
8	2,5	0.01467
9	2,6	0.02445
10	3,4	0.01797
11	3,5	0.02200
12	3,6	0.03667
13	4,5	0.004492
14	4,6	0.007487
15	5,6	0.009168

Unit	p_i
I	0.1861
II	0.1098
III	0.2087
IV	0.0569
V	0.06867
VI	0.1083

```
a1 <- 200
a2 <- 160
a3 <- 240
a4 <- 49
a5 <- 60
a6 <- 100
total.area <- a1 + a2 + a3 + a4 + a5 + a6
p12 <- a1*a2/total.area^2
p13 <- a1*a3/total.area^2
p14 <- a1*a4/total.area^2
p15 <- a1*a5/total.area^2
p16 <- a1*a6/total.area^2
p23 <- a2*a3/total.area^2
```

```
p24 <- a2*a4/total.area^2
p25 <- a2*a5/total.area^2
p26 <- a2*a6/total.area^2
p34 <- a3*a4/total.area^2
p35 <- a3*a5/total.area^2
p36 <- a3*a6/total.area^2
p45 <- a4*a5/total.area^2
p46 <- a4*a6/total.area^2
p56 <- a5*a6/total.area^2
pi.1 <- sum(p12, p13, p14, p15, p16)
pi.2 <- sum(p12, p23, p24, p25, p26)
pi.3 <- sum(p13, p23, p34, p35, p36)
pi.4 <- sum(p14, p24, p34, p45, p46)
pi.5 <- sum(p15, p25, p35, p45, p56)
pi.6 <- sum(p16, p26, p36, p46, p56)
pi <- c(pi.1, pi.2, pi.3, pi.4, pi.5, pi.6)
```

(b) The table below shows the y_i/p_i values. The R code is shown below.

```
y1 <- 248
y2 <- 204
y3 <- 305
y4 <- 49
y5 <- 78
y6 <- 126
y <- c(y1, y2, y3, y4, y5, y6)
y.pi <- y/pi
unit <- c("I", "II", "III", "IV", "V", "VI")
xtable(cbind.data.frame(unit, y, "p_i" = pi, "y/p_i" = y.pi))
```

	unit	y	p_i	y/p_i
1	I	248.00	0.19	1332.60
2	II	204.00	0.16	1285.77
3	III	305.00	0.21	1461.75
4	IV	49.00	0.06	861.16
5	V	78.00	0.07	1135.95
6	VI	126.00	0.11	1163.11

(c) Yes, Hansen Hurwitz estimation will provide an estimate of $\bar{y}_U$ with small variance because the selection probabilities p_i are proportional to the y_i values.

R code appendix