FA5

Dizon, Kiana Marie

2024-09-24

Problem 8.18

```
population <- c(9, 12, 15)
samples <- expand.grid(population, population)


xbar <- rowMeans(samples)
p_xbar <- table(xbar) / length(xbar)


sample_data <- data.frame(
  "Sample A" = samples$Var1,
  "Sample B" = samples$Var2,
  "x" = xbar,
  "p(x)" = p_xbar[as.character(xbar)],
  "x¯× p(x)" = xbar * p_xbar[as.character(xbar)],
  "x² × p(x)" = (xbar^2) * p_xbar[as.character(xbar)]
)

knitr::kable(sample_data, digits = 6, caption = "Samples, Means, and Probabilities")
```

Samples, Means, and Probabilities

Sample.A	Sample.B	x.	p.x…xbar	p.x…Freq	x….p.x…xbar	x….p.x…Freq	x…..p.x…xbar	x…..p.x…Freq
9	9	9.0	9	0.111111	9	1.000000	9	9.0
12	9	10.5	10.5	0.222222	10.5	2.333333	10.5	24.5
15	9	12.0	12	0.333333	12	4.000000	12	48.0
9	12	10.5	10.5	0.222222	10.5	2.333333	10.5	24.5
12	12	12.0	12	0.333333	12	4.000000	12	48.0
15	12	13.5	13.5	0.222222	13.5	3.000000	13.5	40.5
9	15	12.0	12	0.333333	12	4.000000	12	48.0
12	15	13.5	13.5	0.222222	13.5	3.000000	13.5	40.5
15	15	15.0	15	0.111111	15	1.666667	15	25.0

Problem 8.21

```
population <- c(3, 7, 11, 15)

mu_pop <- mean(population)
sigma2_pop <- var(population)
sigma_pop <- sqrt(sigma2_pop)

mu_pop
```

```
## [1] 9
```

```
sigma_pop
```

```
## [1] 5.163978
```

Problem 8.34

```
n <- 200
p <- 0.5

p_boys_40 <- pbinom(0.4 * n, n, p)


p_girls_43_57 <- pbinom(0.57 * n, n, 1 - p) - pbinom(0.43 * n, n, 1 - p)


p_boys_54 <- 1 - pbinom(0.54 * n, n, p)

p_boys_40
```

```
## [1] 0.002842578
```

```
p_girls_43_57
```

```
## [1] 0.9519985
```

```
p_boys_54
```

```
## [1] 0.1146233
```

Problem 8.49

```
x <- c(6, 9, 12, 15, 18)
p_x <- c(0.1, 0.2, 0.4, 0.2, 0.1)


mu_x <- sum(x * p_x)
sigma2_x <- sum((x - mu_x)^2 * p_x)
sigma_x <- sqrt(sigma2_x)

mu_x
```

```
## [1] 12
```

```
sigma_x
```

```
## [1] 3.286335
```

```
samples <- expand.grid(x, x)
means <- rowMeans(samples)


p_means <- apply(samples, 1, function(sample) p_x[which(x == sample[1])] * p_x[which(x == sample[2])])

sample_data <- data.frame(samples, means, p_means)
head(sample_data)
```

```
##   Var1 Var2 means p_means
## 1    6    6   6.0    0.01
## 2    9    6   7.5    0.02
## 3   12    6   9.0    0.04
## 4   15    6  10.5    0.02
## 5   18    6  12.0    0.01
## 6    6    9   7.5    0.02
```