

p8122_HW1

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Question 1a

```
individuals <- data.frame(  
  Individual = 1:8,  
  Y0 = c(0, 1, 0, 1, 1, 0, 1, 0),  
  Y1 = c(0, 0, 1, 0, 0, 1, 0, 0)  
)  
  
# calculate treatment effects  
individuals <- individuals %>%  
  mutate(TE = Y1 - Y0) # add a col TE  
  
individuals %>%  
  kable()
```

Individual	Y0	Y1	TE
1	0	0	0
2	1	0	-1
3	0	1	1
4	1	0	-1
5	1	0	-1
6	0	1	1
7	1	0	-1
8	0	0	0

Question 1b

```
ACE <- individuals %>%  
  summarise(ACE = mean(TE)) %>%  
  pull(ACE)  
  
cat("The average causal effect (ACE) is:", ACE, "\n")
```

```
## The average causal effect (ACE) is: -0.25
```

Question 1c

```
assigned_treatment <- c(1, 0, 1, 1, 0, 0, 0, 1)

individuals <- individuals %>%
  mutate(Assigned_Treatment = assigned_treatment,
         Observed = ifelse(assigned_treatment == 1, Y1, Y0))

cat("Table: Observed Outcomes under Assigned Treatment\n")
```

Table: Observed Outcomes under Assigned Treatment

```
individuals %>%
  select(Individual, Y0, Y1, Assigned_Treatment, Observed) %>%
  kable()
```

Individual	Y0	Y1	Assigned_Treatment	Observed
1	0	0	1	0
2	1	0	0	1
3	0	1	1	1
4	1	0	1	0
5	1	0	0	1
6	0	1	0	0
7	1	0	0	1
8	0	0	1	0

```
mean_treatment <- individuals %>%
  filter(Assigned_Treatment == 1) %>%
  summarise(mean_treatment = mean(Observed)) %>%
  pull(mean_treatment)

mean_control <- individuals %>%
  filter(Assigned_Treatment == 0) %>%
  summarise(mean_control = mean(Observed)) %>%
  pull(mean_control)

association <- mean_treatment - mean_control
cat("The association between treatment and outcome under specific treatment assignment is:", association)
```

The association between treatment and outcome under specific treatment assignment is: -0.5

Interpretation:

The association between treatment and outcome under the specific treatment assignment is -0.5, which indicates individuals in the treatment group had worse health status (mean = 0.25) compared to the control group (mean = 0.75).

Question 1d

```
set.seed(329)
random_assignment <- sample(c(0, 1), size = 8, replace = TRUE)

individuals <- individuals %>%
  mutate(Random_Assigned_Treatment = random_assignment,
         Random_Assigned_Observed = ifelse(random_assignment == 1, Y1, Y0))

cat("Table: Observed Outcomes under Random Assignment\n")
```

```
## Table: Observed Outcomes under Random Assignment
```

```
individuals %>%
  select(Individual, Y0, Y1, Random_Assigned_Treatment, Random_Assigned_Observed) %>%
  kable()
```

Individual	Y0	Y1	Random_Assigned_Treatment	Random_Assigned_Observed
1	0	0	0	0
2	1	0	1	0
3	0	1	0	0
4	1	0	0	1
5	1	0	1	0
6	0	1	0	0
7	1	0	1	0
8	0	0	1	0

```
# Calculate the association for random assignment
mean_treatment_random <- individuals %>%
  filter(Random_Assigned_Treatment == 1) %>%
  summarise(mean_treatment_random = mean(Random_Assigned_Observed)) %>%
  pull(mean_treatment_random)

mean_control_random <- individuals %>%
  filter(Random_Assigned_Treatment == 0) %>%
  summarise(mean_control_random = mean(Random_Assigned_Observed)) %>%
  pull(mean_control_random)

association_random <- mean_treatment_random - mean_control_random
cat("The association between treatment and outcome under random assignment is:", association_random, "\n")
```

```
## The association between treatment and outcome under random assignment is: -0.25
```

```
# Compare with part 1b result (ACE)
cat("The ACE calculated in part 1b is:", ACE, "\n")
```

```
## The ACE calculated in part 1b is: -0.25
```

```
cat("Comparison: Association under random assignment:", association_random, "vs ACE:", ACE, "\n")
```

```
## Comparison: Association under random assignment: -0.25 vs ACE: -0.25
```