

p8124_hw1

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Question1

```
install.packages("dagitty")
```

```
##  
## The downloaded binary packages are in  
## /var/folders/nl/np7vbbx920z4vn81k8y5gwq00000gn/T//Rtmpx3P6ye/downloaded_packages
```

```
library(dagitty)
```

```
#a)  
dag <- dagitty('dag {  
  C->E;C->B;C->F;C->H;D->E;E->A;E->F;B->A;G->B;G->H;F->G;F->H  
}')  
  
paths_list <- paths(dag, from = "C", to = "H")  
print(paths_list)
```

```
## $paths  
## [1] "C -> B -> A <- E -> F -> G -> H" "C -> B -> A <- E -> F -> H"  
## [3] "C -> B <- G -> H" "C -> B <- G <- F -> H"  
## [5] "C -> E -> A <- B <- G -> H" "C -> E -> A <- B <- G <- F -> H"  
## [7] "C -> E -> F -> G -> H" "C -> E -> F -> H"  
## [9] "C -> F -> G -> H" "C -> F -> H"  
## [11] "C -> F <- E -> A <- B <- G -> H" "C -> H"  
##  
## $open  
## [1] FALSE FALSE FALSE FALSE FALSE FALSE TRUE TRUE TRUE TRUE FALSE TRUE
```

```
#b)  
d_sep_result <- dseparated(dag, X = "E", Y = "G", Z = c("A", "B"))  
print(d_sep_result)
```

```
## [1] FALSE
```

```
#c)  
independencies <- impliedConditionalIndependencies(dag)  
print(independencies)
```

```

## A _||_ C | B, E
## A _||_ D | C, E
## A _||_ D | B, E
## A _||_ F | C, E, G
## A _||_ F | B, E
## A _||_ G | B, C, F
## A _||_ G | B, E
## A _||_ H | C, F, G
## A _||_ H | C, E, G
## A _||_ H | B, C, F
## A _||_ H | B, E
## B _||_ D | C, E
## B _||_ D | C, F
## B _||_ D | C, G
## B _||_ E | C, F
## B _||_ E | C, G
## B _||_ F | C, G
## B _||_ H | C, G
## C _||_ D
## C _||_ G | F
## D _||_ F | C, E
## D _||_ G | F
## D _||_ G | C, E
## D _||_ H | C, F
## D _||_ H | C, E
## E _||_ G | F
## E _||_ H | C, F

```

```

independencies2 <- impliedConditionalIndependencies(dag, type = "all.pairs")
print(independencies2)

```

```

## A _||_ C | B, E
## A _||_ C | B, D, E
## A _||_ C | B, E, F
## A _||_ C | B, D, E, F
## A _||_ C | B, E, G
## A _||_ C | B, D, E, G
## A _||_ C | B, E, F, G
## A _||_ C | B, D, E, F, G
## A _||_ C | B, E, H
## A _||_ C | B, D, E, H
## A _||_ C | B, E, F, H
## A _||_ C | B, D, E, F, H
## A _||_ C | B, E, G, H
## A _||_ C | B, D, E, G, H
## A _||_ C | B, E, F, G, H
## A _||_ C | B, D, E, F, G, H
## A _||_ D | B, E
## A _||_ D | C, E
## A _||_ D | B, C, E
## A _||_ D | B, E, F
## A _||_ D | C, E, F
## A _||_ D | B, C, E, F
## A _||_ D | B, E, G

```

```

## A _||_ D | C, E, G
## A _||_ D | B, C, E, G
## A _||_ D | B, E, F, G
## A _||_ D | C, E, F, G
## A _||_ D | B, C, E, F, G
## A _||_ D | B, E, H
## A _||_ D | C, E, H
## A _||_ D | B, C, E, H
## A _||_ D | B, E, F, H
## A _||_ D | C, E, F, H
## A _||_ D | B, C, E, F, H
## A _||_ D | B, E, G, H
## A _||_ D | C, E, G, H
## A _||_ D | B, C, E, G, H
## A _||_ D | B, E, F, G, H
## A _||_ D | C, E, F, G, H
## A _||_ D | B, C, E, F, G, H
## A _||_ F | B, E
## A _||_ F | B, C, E
## A _||_ F | B, D, E
## A _||_ F | B, C, D, E
## A _||_ F | B, E, G
## A _||_ F | C, E, G
## A _||_ F | B, C, E, G
## A _||_ F | B, D, E, G
## A _||_ F | C, D, E, G
## A _||_ F | B, C, D, E, G
## A _||_ F | B, E, H
## A _||_ F | B, C, E, H
## A _||_ F | B, D, E, H
## A _||_ F | B, C, D, E, H
## A _||_ F | B, E, G, H
## A _||_ F | C, E, G, H
## A _||_ F | B, C, E, G, H
## A _||_ F | B, D, E, G, H
## A _||_ F | C, D, E, G, H
## A _||_ F | B, C, D, E, G, H
## A _||_ G | B, E
## A _||_ G | B, C, E
## A _||_ G | B, D, E
## A _||_ G | B, C, D, E
## A _||_ G | B, C, F
## A _||_ G | B, C, D, F
## A _||_ G | B, E, F
## A _||_ G | B, C, E, F
## A _||_ G | B, D, E, F
## A _||_ G | B, C, D, E, F
## A _||_ G | B, E, H
## A _||_ G | B, C, E, H
## A _||_ G | B, D, E, H
## A _||_ G | B, C, D, E, H
## A _||_ G | B, C, F, H
## A _||_ G | B, C, D, F, H
## A _||_ G | B, E, F, H

```

```

## A _||_ G | B, C, E, F, H
## A _||_ G | B, D, E, F, H
## A _||_ G | B, C, D, E, F, H
## A _||_ H | B, E
## A _||_ H | B, C, E
## A _||_ H | B, D, E
## A _||_ H | B, C, D, E
## A _||_ H | B, C, F
## A _||_ H | B, C, D, F
## A _||_ H | B, E, F
## A _||_ H | B, C, E, F
## A _||_ H | B, D, E, F
## A _||_ H | B, C, D, E, F
## A _||_ H | B, E, G
## A _||_ H | C, E, G
## A _||_ H | B, C, E, G
## A _||_ H | B, D, E, G
## A _||_ H | C, D, E, G
## A _||_ H | B, C, D, E, G
## A _||_ H | C, F, G
## A _||_ H | B, C, F, G
## A _||_ H | C, D, F, G
## A _||_ H | B, C, D, F, G
## A _||_ H | B, E, F, G
## A _||_ H | C, E, F, G
## A _||_ H | B, C, E, F, G
## A _||_ H | B, D, E, F, G
## A _||_ H | C, D, E, F, G
## A _||_ H | B, C, D, E, F, G
## B _||_ D | C, E
## B _||_ D | A, C, E
## B _||_ D | C, F
## B _||_ D | C, E, F
## B _||_ D | A, C, E, F
## B _||_ D | C, G
## B _||_ D | C, E, G
## B _||_ D | A, C, E, G
## B _||_ D | C, F, G
## B _||_ D | C, E, F, G
## B _||_ D | A, C, E, F, G
## B _||_ D | C, E, H
## B _||_ D | A, C, E, H
## B _||_ D | C, F, H
## B _||_ D | C, E, F, H
## B _||_ D | A, C, E, F, H
## B _||_ D | C, G, H
## B _||_ D | C, E, G, H
## B _||_ D | A, C, E, G, H
## B _||_ D | C, F, G, H
## B _||_ D | C, E, F, G, H
## B _||_ D | A, C, E, F, G, H
## B _||_ E | C, F
## B _||_ E | C, D, F
## B _||_ E | C, G

```

```

## B _||_ E | C, D, G
## B _||_ E | C, F, G
## B _||_ E | C, D, F, G
## B _||_ E | C, F, H
## B _||_ E | C, D, F, H
## B _||_ E | C, G, H
## B _||_ E | C, D, G, H
## B _||_ E | C, F, G, H
## B _||_ E | C, D, F, G, H
## B _||_ F | C, G
## B _||_ F | C, D, G
## B _||_ F | C, E, G
## B _||_ F | A, C, E, G
## B _||_ F | C, D, E, G
## B _||_ F | A, C, D, E, G
## B _||_ F | C, G, H
## B _||_ F | C, D, G, H
## B _||_ F | C, E, G, H
## B _||_ F | A, C, E, G, H
## B _||_ F | C, D, E, G, H
## B _||_ F | A, C, D, E, G, H
## B _||_ H | C, G
## B _||_ H | C, D, G
## B _||_ H | C, E, G
## B _||_ H | A, C, E, G
## B _||_ H | C, D, E, G
## B _||_ H | A, C, D, E, G
## B _||_ H | C, F, G
## B _||_ H | A, C, F, G
## B _||_ H | C, D, F, G
## B _||_ H | A, C, D, F, G
## B _||_ H | C, E, F, G
## B _||_ H | A, C, E, F, G
## B _||_ H | C, D, E, F, G
## B _||_ H | A, C, D, E, F, G
## C _||_ D
## C _||_ G | F
## C _||_ G | D, F
## C _||_ G | E, F
## C _||_ G | D, E, F
## D _||_ F | C, E
## D _||_ F | A, C, E
## D _||_ F | B, C, E
## D _||_ F | A, B, C, E
## D _||_ F | C, E, G
## D _||_ F | A, C, E, G
## D _||_ F | B, C, E, G
## D _||_ F | A, B, C, E, G
## D _||_ F | C, E, H
## D _||_ F | A, C, E, H
## D _||_ F | B, C, E, H
## D _||_ F | A, B, C, E, H
## D _||_ F | C, E, G, H
## D _||_ F | A, C, E, G, H

```

```

## D _||_ F | B, C, E, G, H
## D _||_ F | A, B, C, E, G, H
## D _||_ G | C, E
## D _||_ G | A, C, E
## D _||_ G | B, C, E
## D _||_ G | A, B, C, E
## D _||_ G | F
## D _||_ G | C, F
## D _||_ G | B, C, F
## D _||_ G | A, B, C, F
## D _||_ G | E, F
## D _||_ G | C, E, F
## D _||_ G | A, C, E, F
## D _||_ G | B, C, E, F
## D _||_ G | A, B, C, E, F
## D _||_ G | C, E, H
## D _||_ G | A, C, E, H
## D _||_ G | B, C, E, H
## D _||_ G | A, B, C, E, H
## D _||_ G | C, F, H
## D _||_ G | B, C, F, H
## D _||_ G | A, B, C, F, H
## D _||_ G | C, E, F, H
## D _||_ G | A, C, E, F, H
## D _||_ G | B, C, E, F, H
## D _||_ G | A, B, C, E, F, H
## D _||_ H | C, E
## D _||_ H | A, C, E
## D _||_ H | B, C, E
## D _||_ H | A, B, C, E
## D _||_ H | C, F
## D _||_ H | B, C, F
## D _||_ H | A, B, C, F
## D _||_ H | C, E, F
## D _||_ H | A, C, E, F
## D _||_ H | B, C, E, F
## D _||_ H | A, B, C, E, F
## D _||_ H | C, E, G
## D _||_ H | A, C, E, G
## D _||_ H | B, C, E, G
## D _||_ H | A, B, C, E, G
## D _||_ H | C, F, G
## D _||_ H | A, C, F, G
## D _||_ H | B, C, F, G
## D _||_ H | A, B, C, F, G
## D _||_ H | C, E, F, G
## D _||_ H | A, C, E, F, G
## D _||_ H | B, C, E, F, G
## D _||_ H | A, B, C, E, F, G
## E _||_ G | F
## E _||_ G | C, F
## E _||_ G | B, C, F
## E _||_ G | A, B, C, F
## E _||_ G | D, F

```

```
## E _||_ G | C, D, F
## E _||_ G | B, C, D, F
## E _||_ G | A, B, C, D, F
## E _||_ G | C, F, H
## E _||_ G | B, C, F, H
## E _||_ G | A, B, C, F, H
## E _||_ G | C, D, F, H
## E _||_ G | B, C, D, F, H
## E _||_ G | A, B, C, D, F, H
## E _||_ H | C, F
## E _||_ H | B, C, F
## E _||_ H | A, B, C, F
## E _||_ H | C, D, F
## E _||_ H | B, C, D, F
## E _||_ H | A, B, C, D, F
## E _||_ H | C, F, G
## E _||_ H | A, C, F, G
## E _||_ H | B, C, F, G
## E _||_ H | A, B, C, F, G
## E _||_ H | C, D, F, G
## E _||_ H | A, C, D, F, G
## E _||_ H | B, C, D, F, G
## E _||_ H | A, B, C, D, F, G
```

```
#d)
library(simsem)
```

```
## Loading required package: lavaan
```

```
## Warning: package 'lavaan' was built under R version 4.3.3
```

```
## This is lavaan 0.6-18
## lavaan is FREE software! Please report any bugs.
```

```
##
```

```
## #####
```

```
## This is simsem 0.5-16
```

```
## simsem is BETA software! Please report any bugs.
```

```
## simsem was first developed at the University of Kansas Center for
```

```
## Research Methods and Data Analysis, under NSF Grant 1053160.
```

```
## #####
```

```
##
```

```
## Attaching package: 'simsem'
```

```
## The following object is masked from 'package:lavaan':
##
##      inspect
```

```
set.seed(111)
simulated_data <- simulateSEM(dag,b.lower = -0.7,b.upper = 0.7, N = 10000)
all_variables <- colnames(simulated_data)
markov_blanket <- markovBlanket(dag, "B")
variables_in_model <- c(markov_blanket, "B")
remaining_variables <- setdiff(all_variables, variables_in_model)
model <- lm(B ~ ., data = simulated_data[, c(variables_in_model, remaining_variables)])
summary(model)$coefficients
```

| | Estimate | Std. Error | t value | Pr(> t) |
|----------------|--------------|-------------|-------------|---------------|
| ## (Intercept) | -0.007144833 | 0.009313298 | -0.76716469 | 4.430017e-01 |
| ## C | 0.309915426 | 0.009559878 | 32.41834392 | 2.648276e-219 |
| ## G | 0.067767441 | 0.009462105 | 7.16198383 | 8.512533e-13 |
| ## A | 0.221582247 | 0.013060715 | 16.96555315 | 1.145067e-63 |
| ## E | 0.138811220 | 0.013067051 | 10.62299521 | 3.214102e-26 |
| ## D | 0.002116303 | 0.009342394 | 0.22652687 | 8.207963e-01 |
| ## F | 0.001135478 | 0.011662614 | 0.09736051 | 9.224421e-01 |
| ## H | 0.020614574 | 0.011875786 | 1.73584925 | 8.262132e-02 |