hw4

1

a

W, Y

b

X, W, Y

c

Y, Z

d

Y, Z, T

e

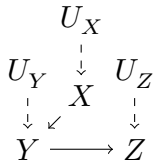
- $X - Y - T$
- $X - Y - Z - T$
- $X - Y - W - Z - T$
- $X - W - Y - T$
- $X - W - Y - Z - T$
- $X - W - Z - T$
- $X - W - Z - Y - T$

f

- $X - Y - T$
- $X - Y - Z - T$
- $X - W - Y - T$
- $X - W - Y - Z - T$
- $X - W - Z - T$

2

a



b

$$E[Z|Y=3] = \sum_z zP(Z=z|Y=3) = 0 \ + \ ... \ + \ 0 + \frac{3}{16} \cdot 1 + 0 + \ ... \ + 0 = \frac{3}{16}$$

c

$$E[Z|X=3] = \sum_z zP(Z=z|X=3) = \frac{1}{16}$$

d

We apply the Markov condition here:

$$E[Z|X=1,Y=3] = \sum_z zP(Z=z|X=1,Y=3) = \sum_z zP(Z=z|Y=3) = \frac{3}{16}$$

3

a

- $\{X, Z_2\}$ are d-separated by $\{Z_3, Z_1\}$
- $\{X, Y\}$ are d-separated by $\{W, Z_2, Z_3\}$
- $\{Z_1, W\}$ are d-separated by $\{X\}$
- $\{Z_1, Z_2\}$ are d-separated by $\{\}$
- $\{Z_1, Y\}$ are d-separated by $\{W, Z_3, Z_2\}$
- $\{Z_3, W\}$ are d-separated by $\{X\}$
- $\{Z_2, W\}$ are d-separated by $\{X\}$

b

- $\{W, Z_3\}$ are d-separated by $\{X\}$
- $\{W, Z_1\}$ are d-separated by $\{X\}$

c

Yes.

4

a

Needs Z and then any combination of A, B, C, D

- $\{Z, D\}, \{Z, C\}, \{Z, B\}, \{Z, A\}$
- $\{Z, D, C\}, \{Z, D, B\}, \{Z, D, A\}, \{Z, C, A\}, \{Z, B, A\}, \{Z, B, C\}$
- $\{X, D, C, B\}, \{Z, D, C, A\}, \{Z, D, B, A\}, \{Z, B, C, A\}$
- $\{Z, D, C, B, A\}$

The minimal ones are

- $\{Z, D\}, \{Z, C\}, \{Z, B\}, \{Z, A\}$

b

must include z or c or both and then any combination of B, A, X, W