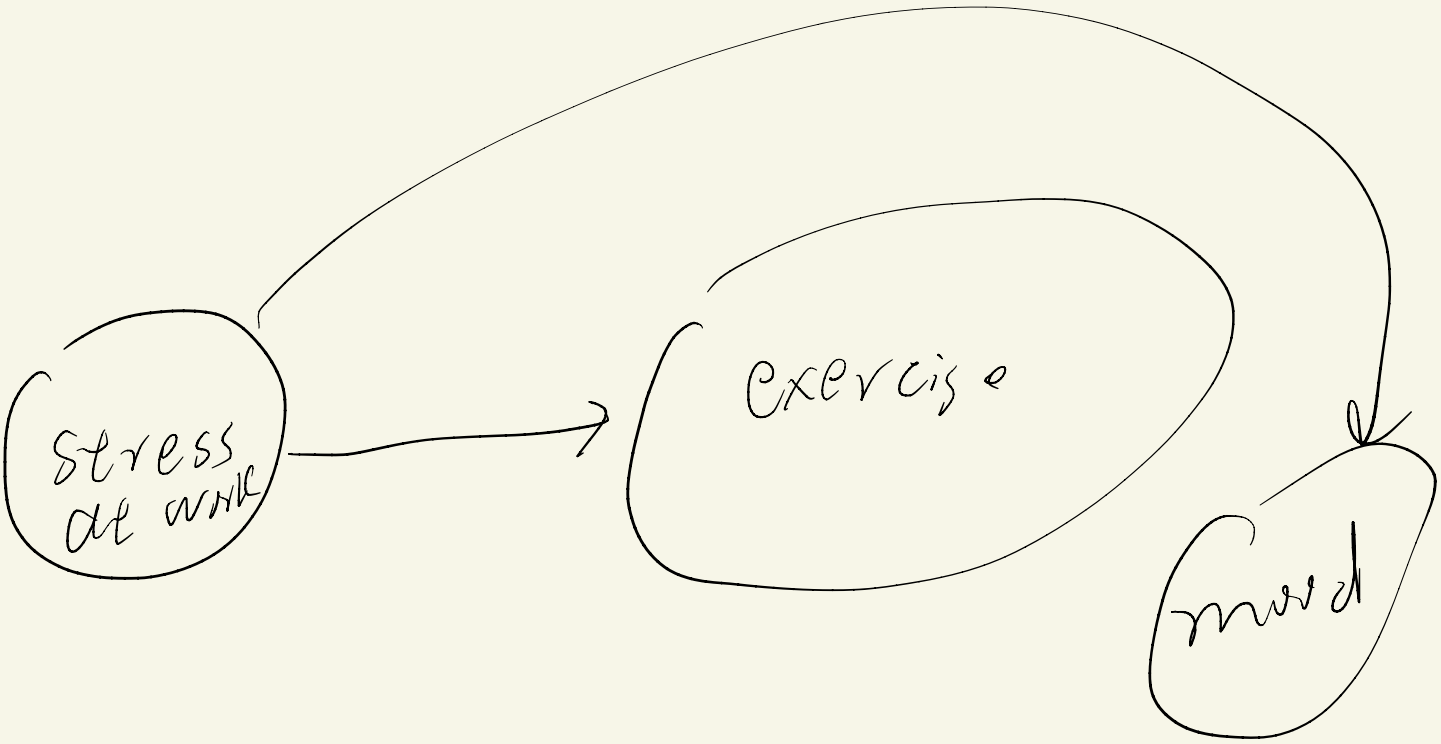
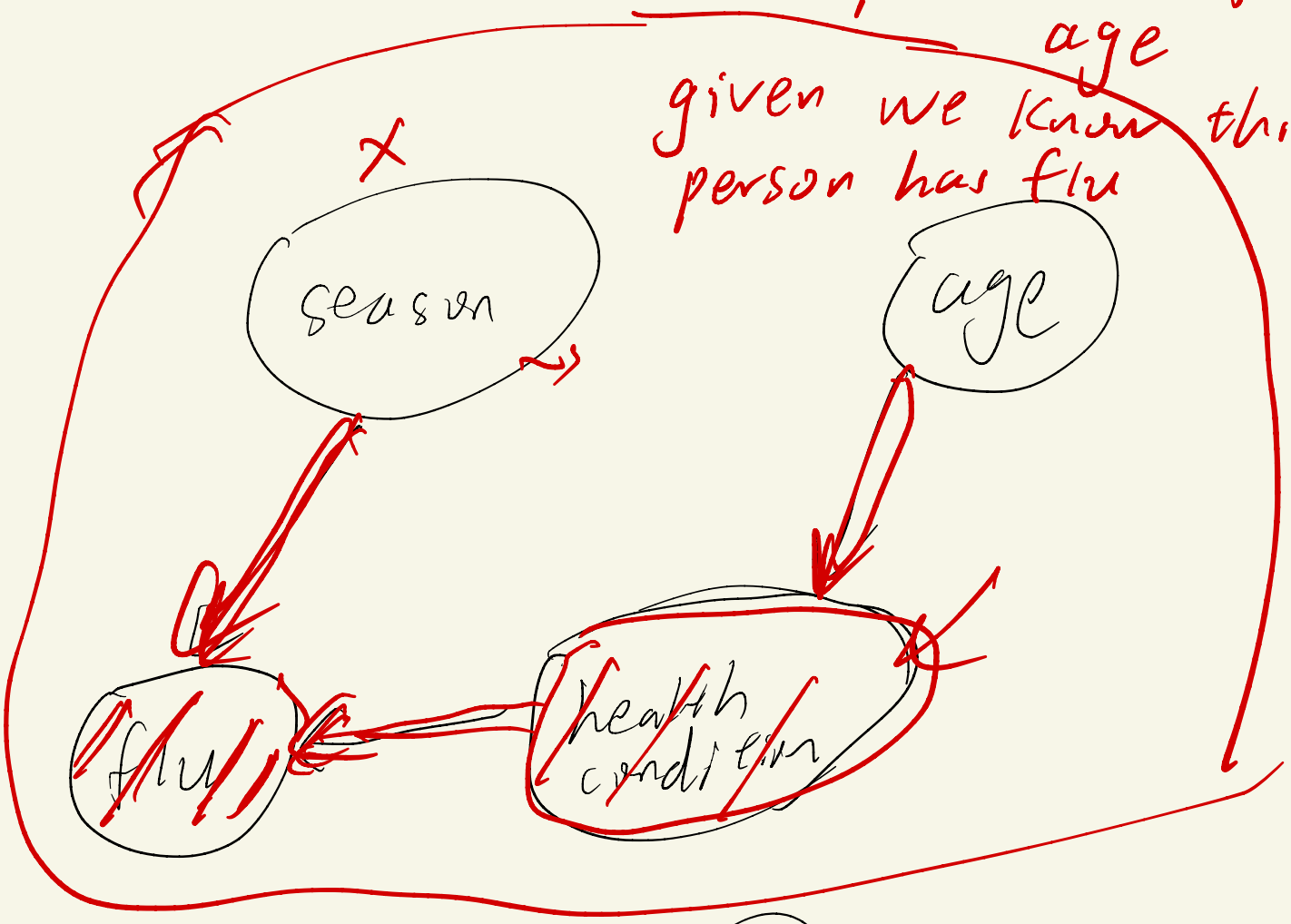
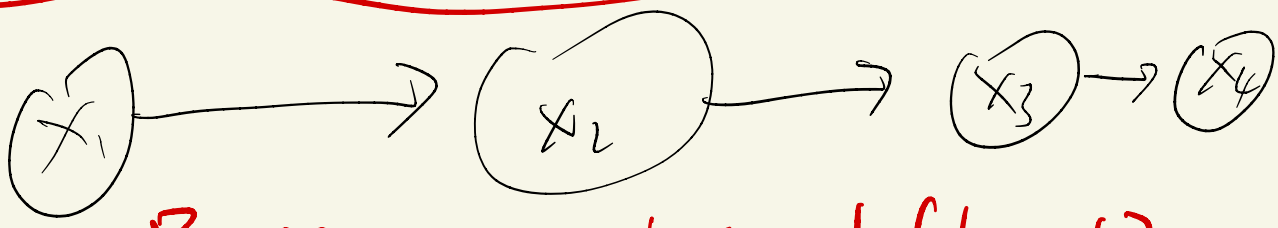
Lecture 15 PGM


stress
at work
exercise
mood

season is independent of age given we know this person has flu





$P(\text{season} = \text{winter} \mid \text{flu} = 1)$

$\neq$

$P(\text{season} = \text{winter} \mid \text{flu} = 1, \text{age} = 80)$

$P(\text{season} = \text{winter} \mid \text{flu} = 1, \text{health condition} = \text{poor})$

$P(\text{season} = \text{winter} \mid \text{flu} = 1, \text{heath}, \text{age} = 80)$

80

$K(x, x) \geq 0$

$K(x, z) = \phi(x)^T \phi(z)$

$$P(x) = \begin{cases} \frac{1}{\pi\theta^2} & \|x\| \leq \theta \\ 0 & \text{otherwise} \end{cases}$$

$\theta \rightarrow$ small

$x = x_1, \ldots x_n$

$$P(x_1, \ldots x_n) = \begin{cases} \frac{1}{(\pi\theta^2)^n} & \text{every } \|x_i\| \leq \theta \\ 0 & \text{any } \|x_i\| > \theta \end{cases}$$

$\theta = \max \|x_i\|$ for $1 \leq i \leq n$

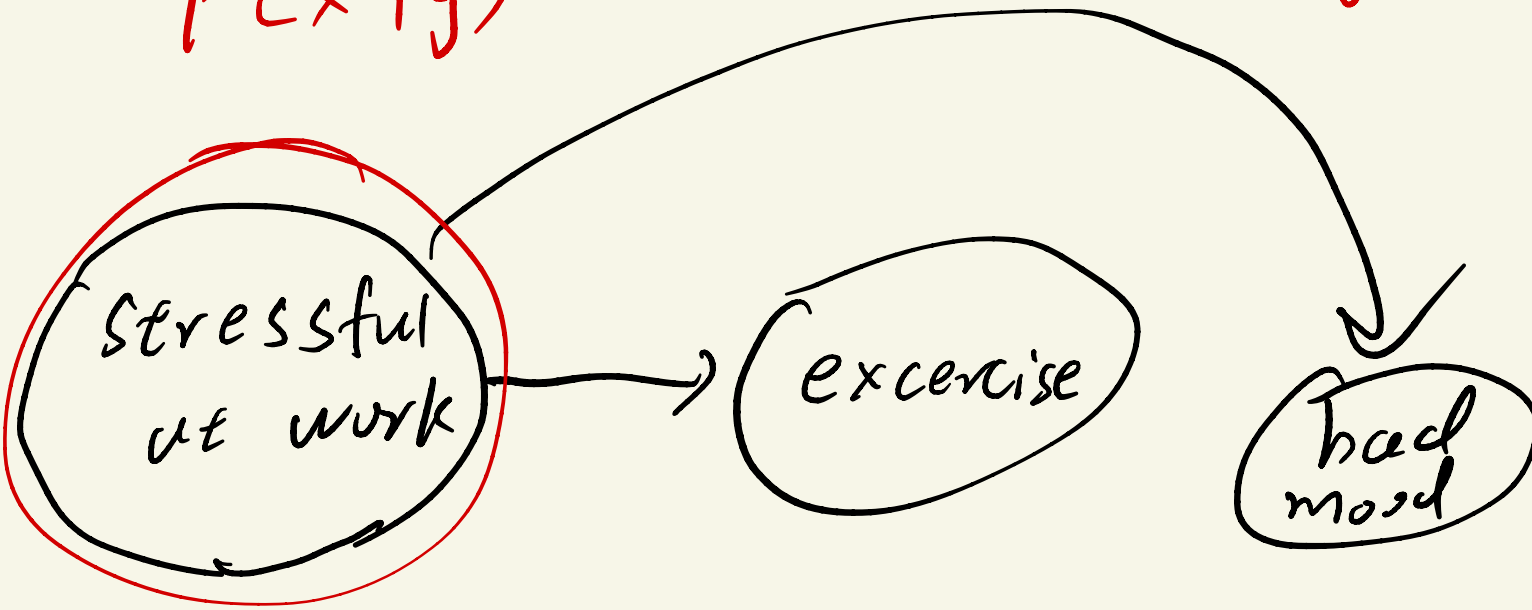
learning rate small

batch size large

accuracy high

$P(y|x)$

$P(x|y)$



excercise causes stress.

excercise ⟷ bad mood

correlated ?

$$P(x_1, x_2 \cdots x_8)$$

$$= P(x_1)\, P(x_2|x_1)\, P(x_3|x_1, x_2) \cdots$$

$$P(x_8|x_1, x_2 \cdots x_7)$$

$x_1 \cdots x_8$ discrete

$x_i \in \{1, \cdots k\}$

k^8

$P(x_1)$ K x_1 x_2

$P(x_2)$ K x_3

$P(x_3 | x_1)$ K^2

$P(x_8 | x_5, x_6)$ K^3

$1 + K + 4K^2 + 2K^3$

$O(K^3)$ $O(K^8)$

$16 \rightarrow O(K^3)$ $O(K^{16})$

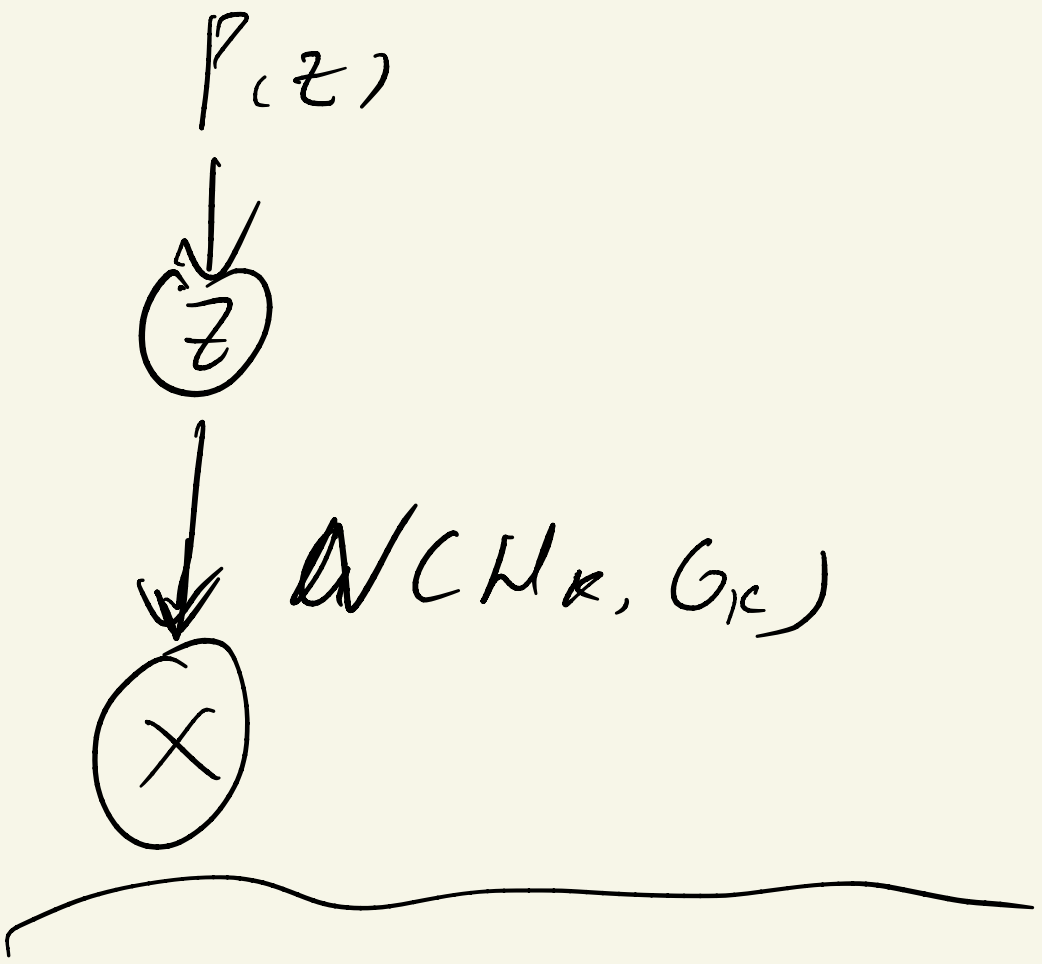
$P(x_1 \cdots x_8)$

$= P(x_1)\, P(x_2) \cdots P(x_8)$

$8K \qquad O(K^3)$

$x_2 \quad x_7$ given x_3

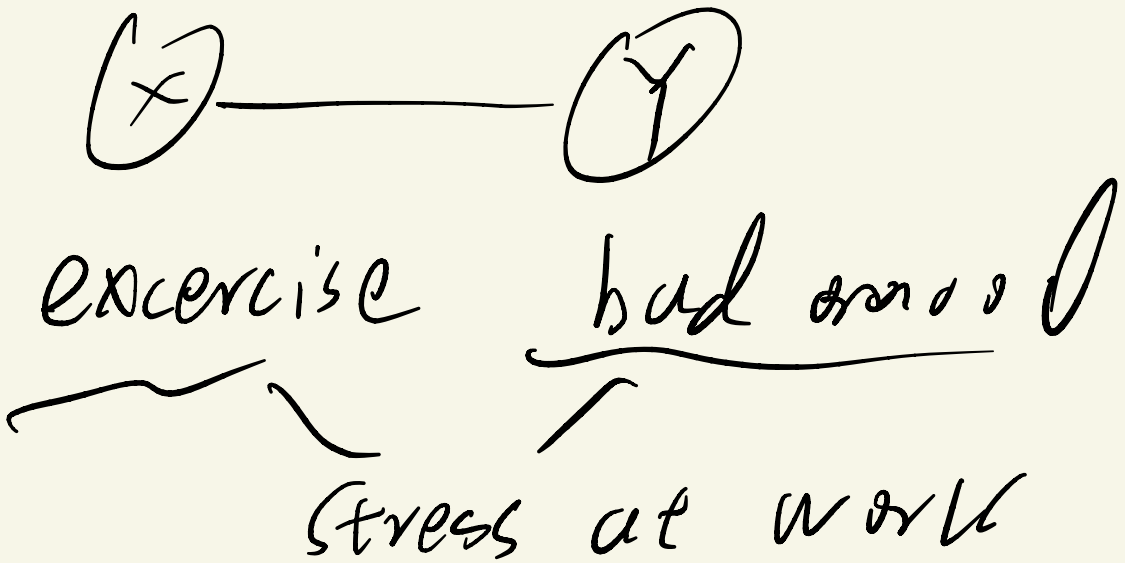
congestion is conditionally independent of season given flu Hayfever



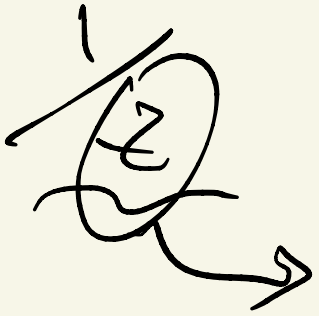
$$P(z, x) = P(z)\,P(x|z)$$

$$P(x, y) = P(x|y)\,P(y)$$

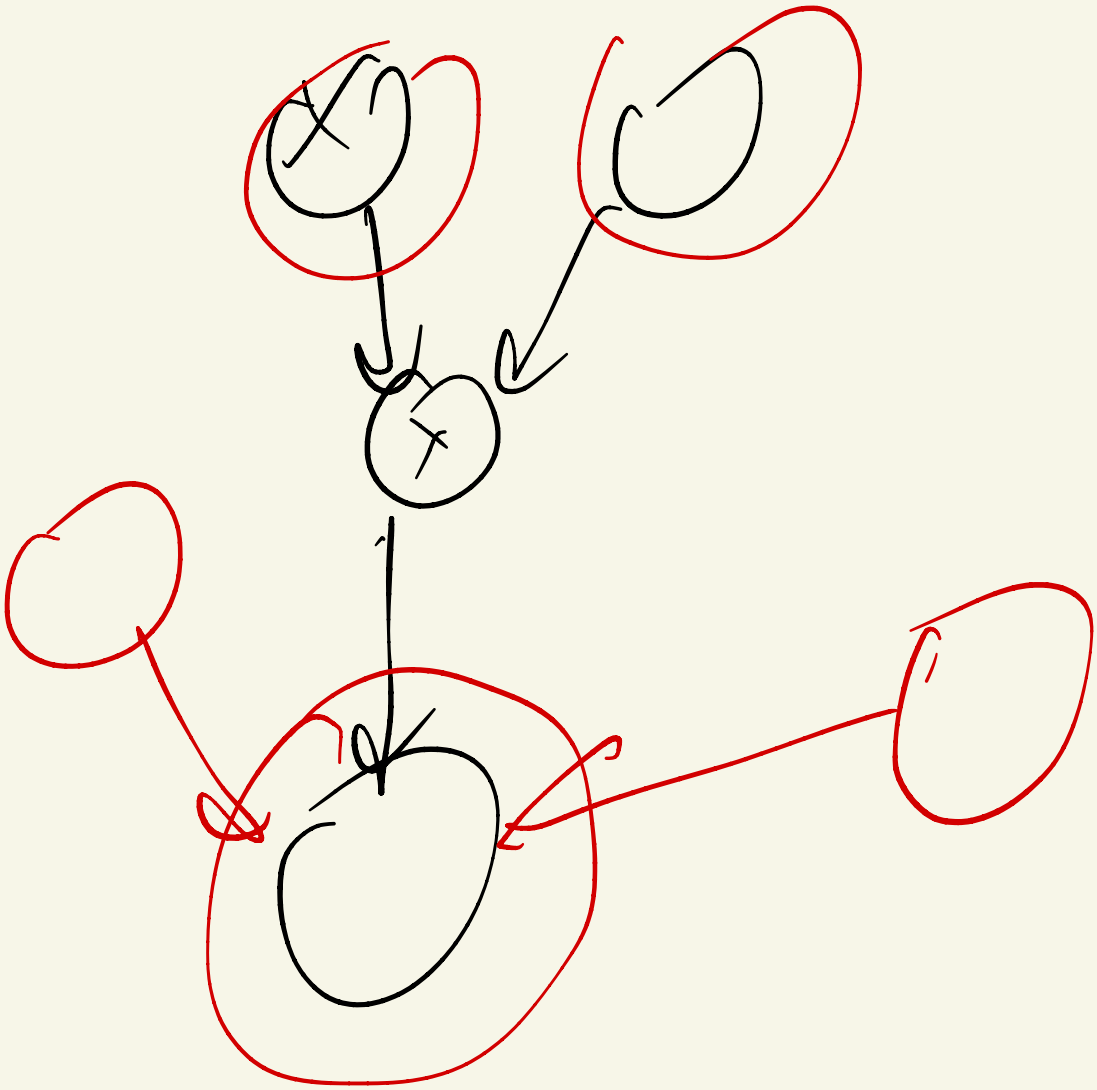
$$= P(y|x)\,P(x)$$



$\bar{E}(x_1, x_2) = \bar{x}_1^T x_2$



$\underset{\sim}{X}$ is conditionally indep...
with all oth RVs -- given
observations of the green...



$\mathcal{N}(\mu, \sigma)$

$\downarrow$

X

$\mathcal{L}$

$\mathcal{O}(K^3)$

$P(x)$

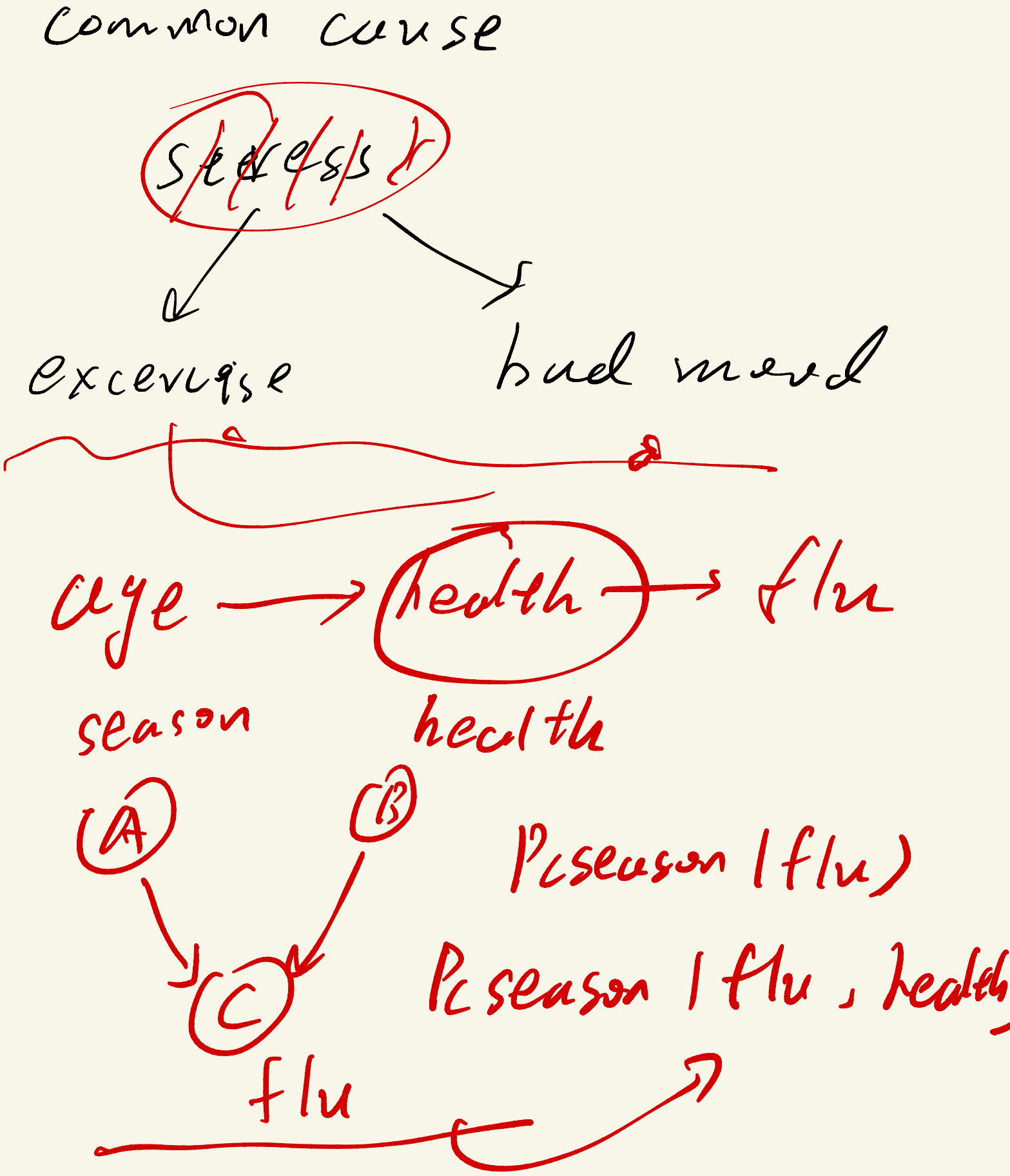
$P(x)$

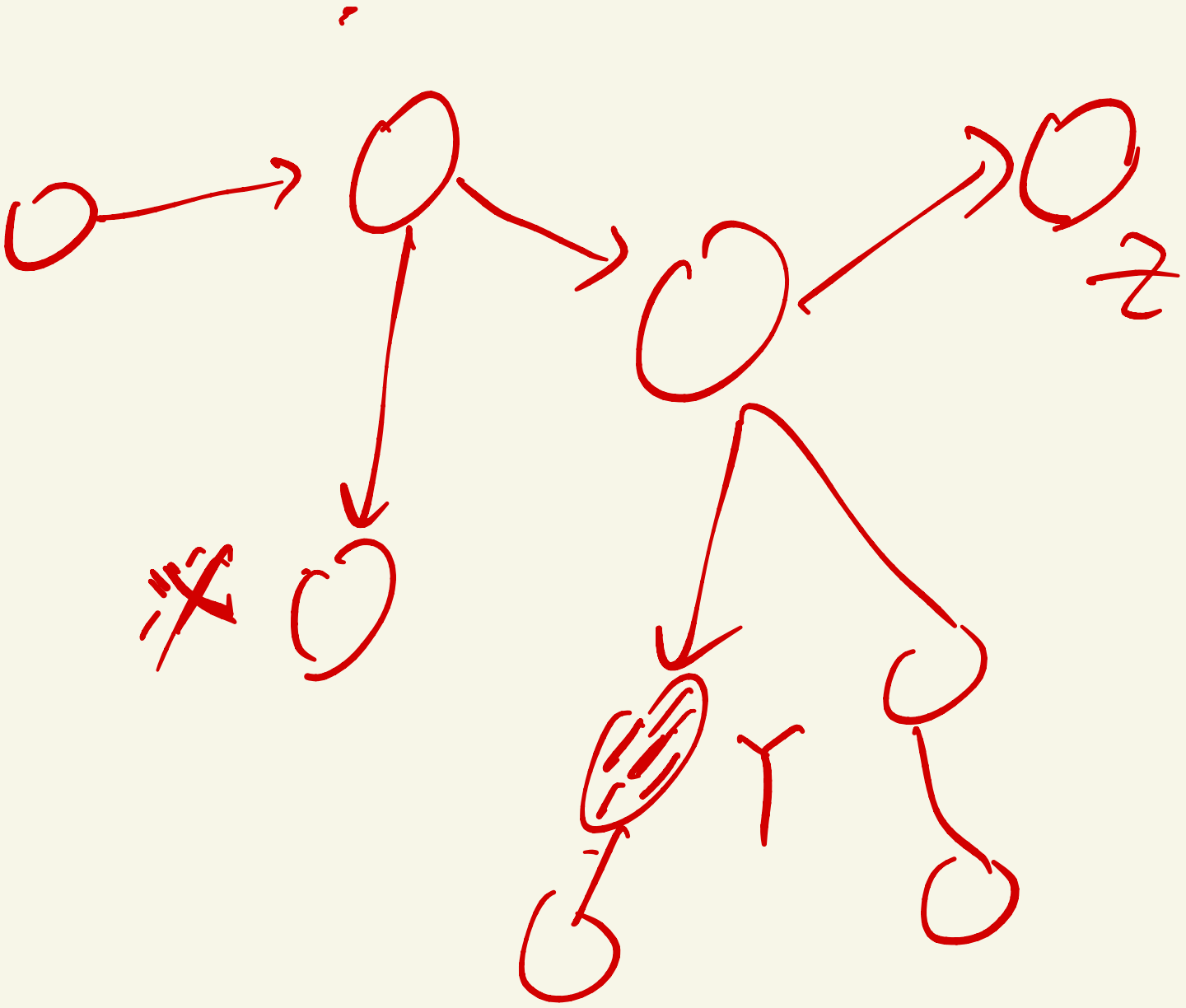
$P(y|x)$

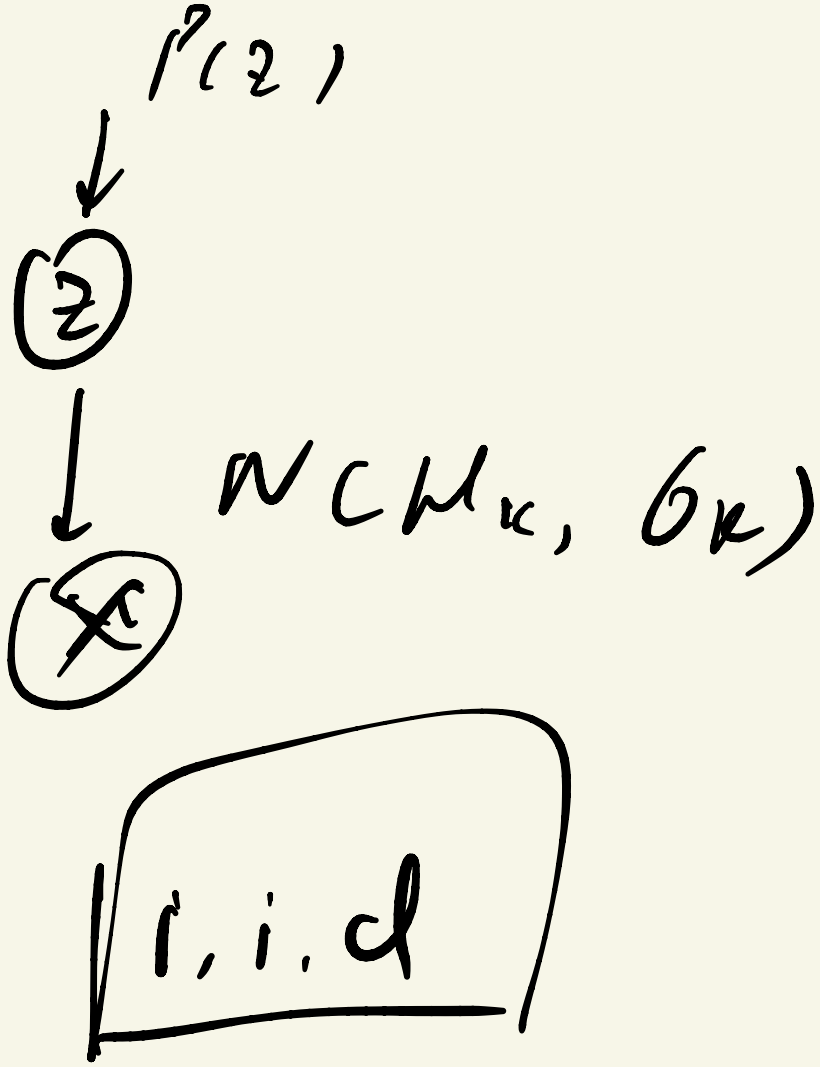
$P(y)$

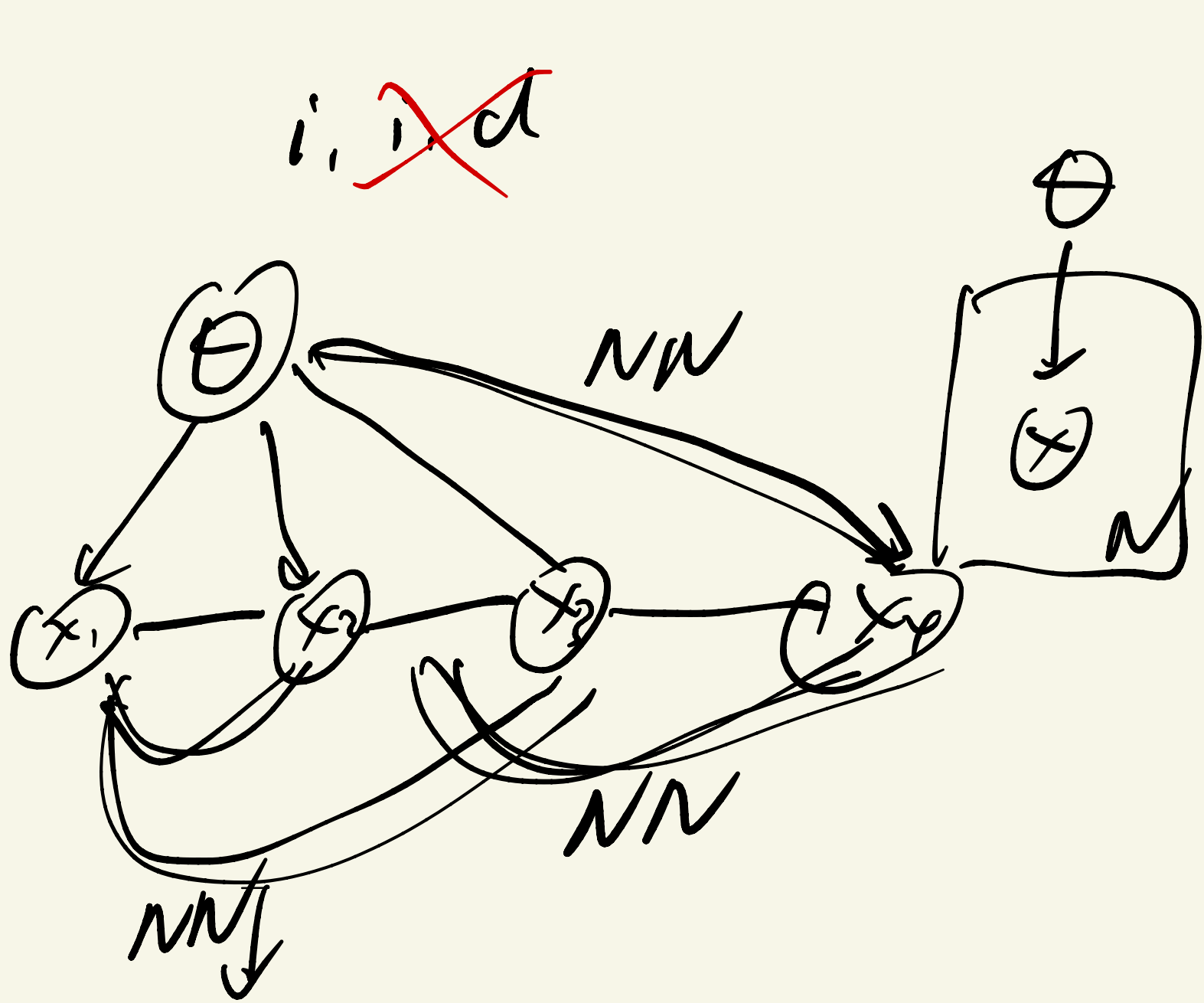
GMM

$P(x|y)$


common cause
stress
exercise
bad mood
age
health
flu
season
health
A
B
C
flu
P(season | flu)
P(season | flu , health


X
Y
Z


P(z)
z
N(μ_k, σ_k)
x
i.i.d


NN
NN
NN