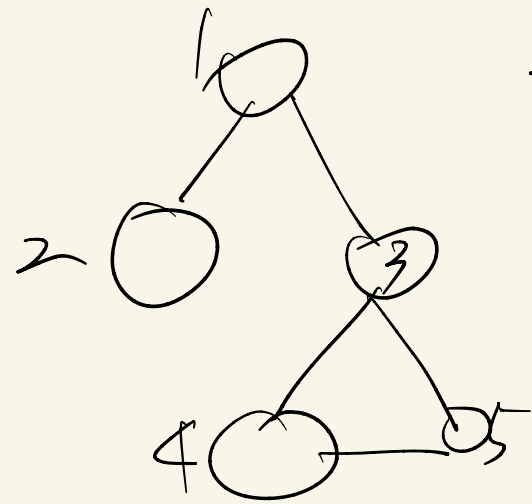


① Briefly explain the difference btw discriminative & generative.

② What are the parameters of the Gaussian?



$$p(x_1, \dots, x_5)$$

$$= \frac{1}{Z} \underbrace{\psi_{12}(x_1, x_2)}_{\uparrow} \underbrace{\psi_{13}(x_1, x_3)}_{\uparrow} \underbrace{\psi_{345}(x_3, x_4, x_5)}_{\uparrow}$$

potential function.

$$Z = \sum_{x_1, \dots, x_5} \psi_{12}(x_1, x_2) \psi_{13}(x_1, x_3) \psi_{345}(x_3, x_4, x_5).$$

```

graph TD
    x1((x1)) --- x2((x2))
    x1 --- x3((x3))
    x2 --- x3
    x3 --- x4((x4))
  
```

x_1	x_2	x_3	ψ_{123}
1	1	1	2
1	1	0	0
1	0	1	0
1	0	0	1
0	1	1	2
0	1	0	0
0	0		0
0		1	0
0	0	0	1

x_3	x_4	ψ_{34}
1	1	1
1	0	0
0	1	0
0	0	3

$$Z = \sum_{x_1, \dots, x_4} \psi_{123}(x_1, x_2, x_3) \psi_{34}(x_3, x_4)$$

$$= \psi_{123}(1, 1, 1) \{ \psi_{34}(1, 0) + \psi_{34}(1, 1) \}$$

$$+ \psi_{123}(1, 1, 0) \{ \psi_{24}(0, 0) + \psi_{24}(0, -1) \}$$

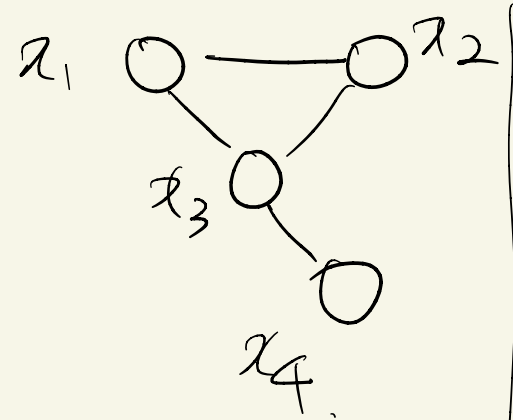
$$+ \vdots$$

$$= 2(1+0) + 1(0+3) + 2(1+0) + 1(0+3) = 10$$

$$\textcircled{E} P(1, 0, 0, 0) = \frac{1}{6} \underbrace{\psi_{123}(1, 0, 0)}_{1} \psi_{24}(0, 0)$$

$$= \frac{1}{6} \cdot 1 \times 3$$

Conditional Independency.



$$x_2 \perp\!\!\!\perp x_4 \mid x_3$$

$$x_1, x_2, x_3, x_4 \in \{0, 1\}^4, \quad x_2 = 1.$$

x_1	x_2	x_3	ψ_{123}
1	1	1	ψ_{11}
1	0	1	ψ_{10}
0	1	1	ψ_{01}
0	0	1	ψ_{00}

x_3	x_4	ϕ_{34}
1	1	ϕ_1
1	0	ϕ_0

$$P(x_4 = 1 \mid x_1 = 0, x_2 = 1, x_3 = 1) = \frac{\cancel{\psi_{01}} \phi_1}{\cancel{\psi_{01}} \phi_1 + \cancel{\psi_{01}} \phi_0}$$

$$= \frac{\phi_1}{\phi_1 + \phi_0}$$

$$P(x_4 = 1 \mid x_1 = 0, x_2 = 0, x_3 = 1) = \frac{\cancel{\psi_{00}} \phi_1}{\cancel{\psi_{00}} \phi_1 + \cancel{\psi_{00}} \phi_0} = \frac{\phi_1}{\phi_1 + \phi_0}$$

$$P(x_4 = 1 \mid x_3 = 1) = \frac{\phi_1}{\phi_1 + \phi_0}$$