Recitation.

Independence.

→ can simplify some cond. prob.

① marginal indep. $A \perp\!\!\!\perp B$. $\boxed{\text{独立}}$

$P(A|B)=P(A)$.

$P(A \cdot B)=P(A)\cdot P(B)$.

②. Cond. indep: $A \perp\!\!\!\perp B | C$.

$P(A|BC) = P(A|C)$.

$P(ABC) = P(A|C)\cdot P(B|C)$

→ reduce #Params. needed to compute joint prob.

k bool vars.

① w/o independence.

| A B | P(AB). |
|---|---|
| T T | $p_1$ |
| T F | $p_2$ |
| F T | $p_3$ |
| F F | $1-(p_1+p_2+p_3)$. |

$2^k-1$ = exhaustion.

② with marginal indep.

$P(AB)=P(A)\cdot P(B)$.

$P(\bar{A}B) = (1-P(A))\cdot P(B)$.

$\boxed{k}$

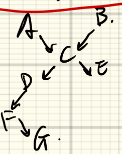
□. BAYES NET.

- representation of independence consumption.
- DAG: no loop.
- may be disconnected.

~~Assumption:~~

A variable is cond. indep. of its non-descendants given its parent.

Ex



$P(F \mid \text{parent}(F), \text{non-des}(F))$

$= P(F \mid \text{parent}(F))$.

$P(F|ABCDE)$

$= P(F|D)$.

5 vars.

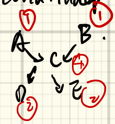
① w/o. indep: $2^5-1=31$.

② w/ con indep. (this chart) 10.

③ w/ marginal indep: 5 $\boxed{P(A)\ P(B)\ C\ D\ E}$

③ with cond. indep

Ex.



$P(A\bar{B}CD\bar{E})$ ← reverse topo. ← given parent.

$= P(\bar{E}\bar{D}C\bar{B}A)$

$= P(\bar{E}|\bar{D}C\bar{B}A)\cdot P(\bar{D}C\bar{B}A)$.

$= P(E|\cancel{\bar{D}}C\cancel{\bar{B}A})\cdot P(\bar{D}|C\cancel{\bar{B}A})\cdot P(C|\bar{B}A)\cdot P(\bar{B}|\cancel{A})\, P(A)$.

$= P(\bar{E}|C)\, P(\bar{D}|C)\cdot P(\bar{B})\cdot P(A)\cdot P(C|\bar{B}A)$.

all encoded in Bayes Net

ex

| A B | P(C\|AB). |
|---|---|
| T T | $p_1$ |
| T F | $p_2$ |
| F T | $p_3$ |
| F F | $p_4$. |

↳ infer $P(\bar{C}|AB)$

$P(ABC)$.

③ with conditional prob $P(C|A=a, B=b)$.

exhaustion all prob

$\boxed{(\#\text{val}-1)\cdot 2^{\#\text{parent}}}$