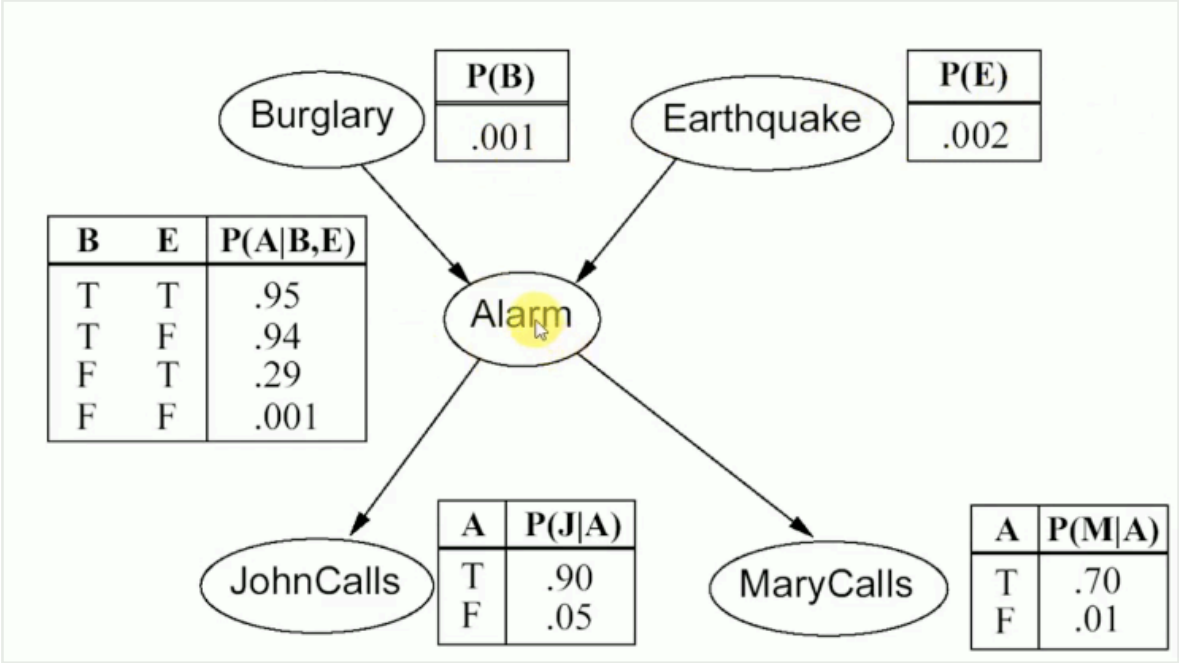
bayesian networks



$P(A, \bar{E}, \bar{B}, J, M) = P(J|A) \cdot P(M|A) \cdot P(A|\bar{E},\bar{B}) \cdot P(\bar{E}) \cdot P(\bar{B})$

$= (0.90)(0.70)(0.001)(0.998)(0.999)$

$P(J) = P(J|A)P(A) + P(J|\bar{A})P(\bar{A}) = (0.90) \cdot P(A) + (0.05) \cdot (1 - P(A))$

$P(A) = (0.95)(0.001)(0.002)$
$+ (0.94)(0.001)(0.998)$
$+ (0.29)(0.999)(0.002)$
$+ (0.001)(0.999)(0.998)$

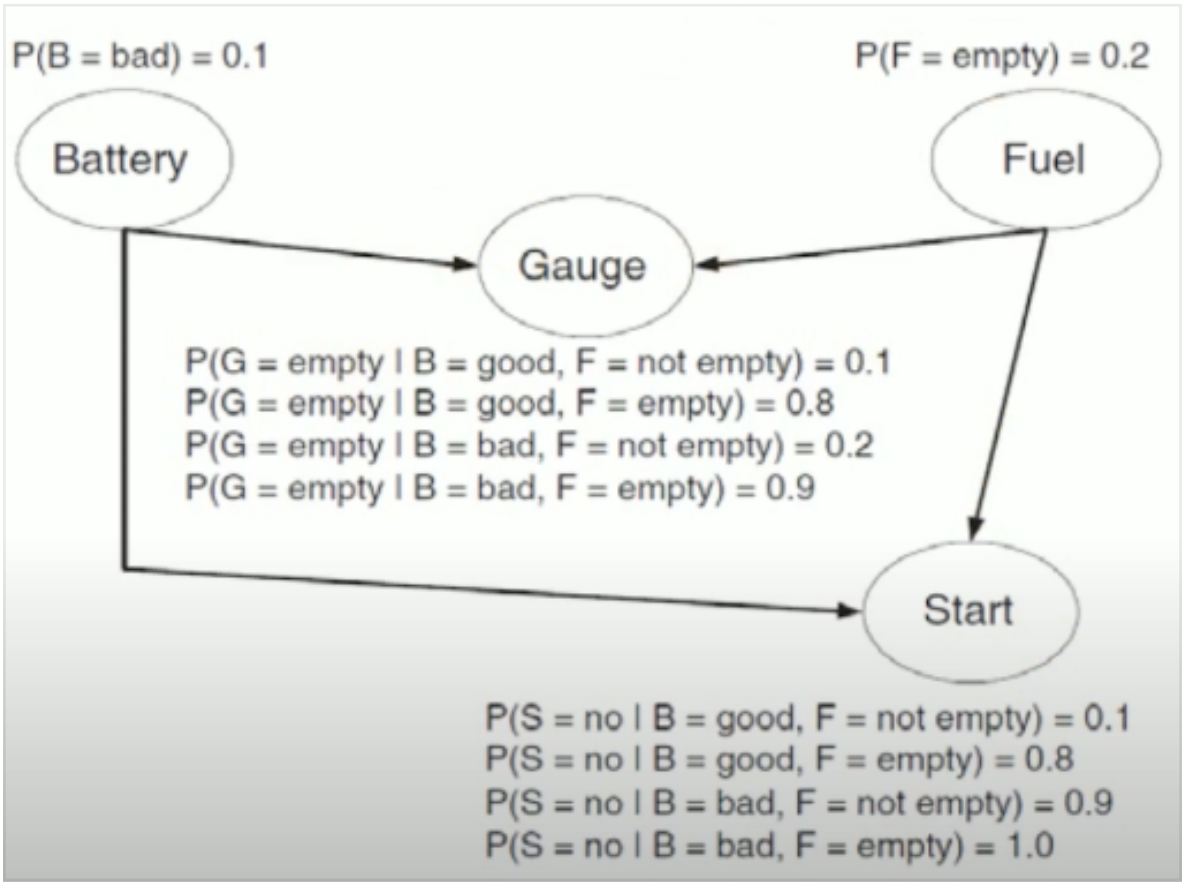
$P(B|J,M) = \frac{P(B,J,M)}{P(J,M)} = \frac{(0.001)(0.59)}{(0.001)(0.59) + (0.999)(0.0015)}$

$P(B,J,M) = (0.001)\,((0.002)(0.95)(0.90)(0.70) + (0.998)(0.94)(0.90)(0.70) + (0.002)(0.05)(0.05)(0.01) + (0.998)(0.06)(0.05)(0.01))$ → 0.59

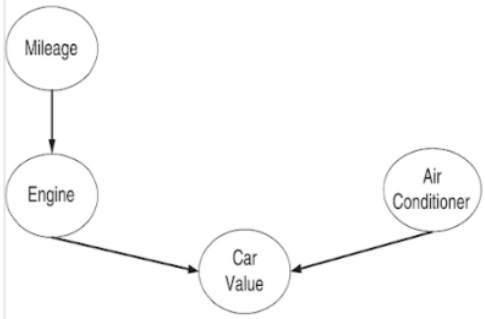
$P(J,M) = P(B,J,M) + P(\bar{B},J,M)$

$P(\bar{B},J,M) = (0.999)\,((0.002)(0.29)(0.90)(0.70) + (0.998)(0.001)(0.90)(0.70) + (0.002)(0.71)(0.05)(0.01) + (0.998)(0.999)(0.05)(0.01))$ → 0.0015

$P(\bar{B}|J,M) = \frac{P(\bar{B},J,M)}{P(J,M)} = \frac{(0.999)(0.0015)}{P(J,M,B) + P(J,M,\bar{B})}$ → same as previous



- $P(B=\text{Good}, F=\text{Empty}, G=\text{Empty}, S=\text{Yes}) = \overset{B}{(0.9)}\overset{F}{(0.2)}\overset{G}{(0.8)}\overset{S}{(0.2)}$
- $P(B=\text{Bad}, F=\text{Empty}, G=\text{Not Empty}, S=\text{No}) = \overset{B}{(0.1)}\overset{F}{(0.2)}\overset{G}{(0.1)}\overset{S}{(1.0)}$
- $P(S=\text{Yes} \mid B=\text{Bad}) = \overset{F=ne}{(0.1)(0.8)} + \overset{F=e}{0}$



Mileage	Engine	Air Conditioner	No of Records with Car Value=Hi	No of Records with Car Value=Lo
Hi	Good	Working	3	4
Hi	Good	Broken	1	2
Hi	Bad	Working	1	5
Hi	Bad	Broken	0	4
Lo	Good	Working	9	0
Lo	Good	Broken	5	1
Lo	Bad	Working	1	2
Lo	Bad	Broken	0	2

- $P(Mil = High) = \frac{20}{40} = 0.5$
- $P(AirC = W) = \frac{25}{40} = 0.625$
- $P(Eng = Good \mid M = High) = \frac{10}{20} = 0.5$
- $P(Eng = Good \mid M = Low) = \frac{15}{20} = 0.75$
- $P(Val = High \mid E = Good, AirC = W) = \frac{12}{16} = 0.75$
- $P(V = High \mid E = G, A = B) = \frac{6}{9} = 0.667$
- $P(Val = High \mid E = B, AirC = W) = \frac{2}{9}$
- $P(V = High \mid E = B, A = B) = \frac{0}{6}$
- $P(E = B, A = B) = P(E = B, A = B, \overrightarrow{Val}^{all}, \overrightarrow{Mil}^{all})$

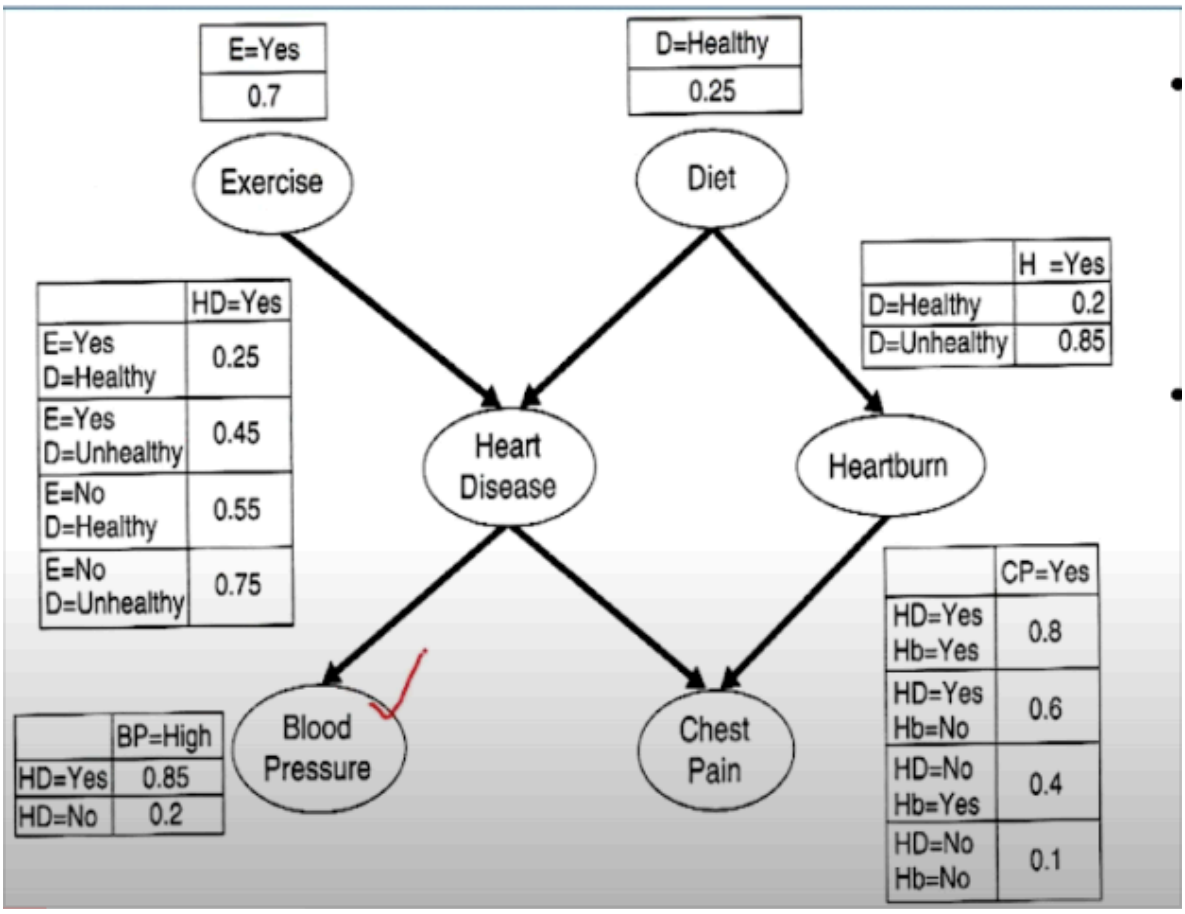
$= P(Val = H \mid E = B, A = B) + P(Val = L \mid E = B, A = B)$

(0) (1)

$1 \cdot P(E = B \mid M) \cdot P(A = B)$

$((0.5)(0.5) + (0.25)(0.5)) \; 0.375 = 0.1406$

0.375



✱ P(heart disease | high blood pressure) = $\frac{P(hbp, hd)}{P(hbp) \rightarrow P(hbp, \overline{hd}) + P(hbp, hd)}$

$P(hbp, \overline{hd})$ {
(0.7)(0.25) (0.75) (0.85)
(0.7) (0.75) (0.55) (0.85)
(0.3) (0.25) (0.45) (0.85)
(0.3) (0.75) (0.25) (0.85)
}

{
(0.7)(0.25) (0.25) (0.85)
(0.7) (0.75) (0.45) (0.85)
(0.3) (0.25) (0.55) (0.85)
(0.3) (0.75) (0.75) (085)
} $P(hdp, hd)$