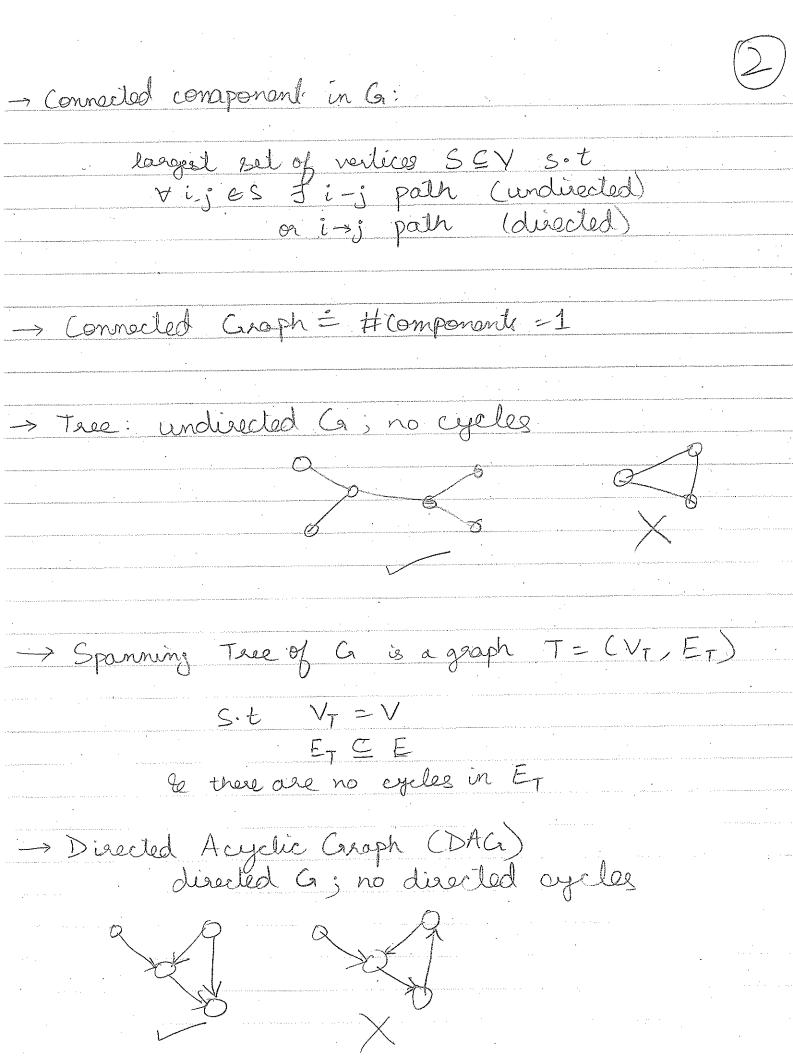
GRAPIS + PROB REVIEW + BN	
D Graph Concepts	
-> G is an ordered pair of tuple of two 2018 G=CV, E)	
Eil of Sol of edges bacs vertices/nodes	
→ V= {A,B,C;,Z}  namee of resilies	
V= {V1, V2, Vn}	
$\rightarrow$ Edge Set: $E = \{(i,j) \mid i \in V, j \in V\}$ Duacted of	yraphe
E={di,;}liev,jev} Undiaected	grophs
typical agesumptions: 1) No self-loops i +3 Ye=(i 2) No repealed edges e, +e Y.e.e	njet 2 2 EE

-> Weighted Groph G=CV, E, W?
$\rightarrow$ Weighted Graph $G = CV, E, W$ ?  Where $W = \{ w_1, w_2, \dots, w_{ E } \}$
weight associated with edge e,
> Neighbour > Undirected Ca: NCi) = {j/fi.jg EE}
→ Parent/Child (Directed grophs)
$(i,j) \in E \Rightarrow i \text{ is a parent of } j$ $j \text{ is a child of } i$
j is a child of i
> 10 10 1 L \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
> Walk: Sequence of neatures V, V2 Vx S.t. (Vi, Vi) EE
a ly, Yig E E
, Path: Walk with no repeated nodes
> Cycle: Path with V, = V, (start = end)



Ancostor:	i is on	r ancest	or of ji	d J 1→j	palh
	il: j is		•	•	
2) Probability [As an in the	Refreshe appendix;	R Notes fro	m F13:	4984/598	34)
		· · · · · · · · · · · · · · · · · · ·			

(5)		11 1
(3)	Kayee	Nells
\		

## (3.1) Let's start with Chain Rule

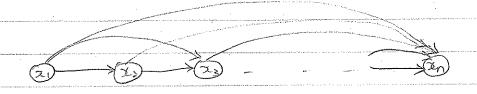
 $P(x_1, -.., x_n) = P(x_1) P(x_2 -.. x_n | x_n)$   $= P(x_1) P(x_2 | x_n) P(x_3 -... x_n | x_1, x_2)$ 

= P(x) 1 P(x, 1 x, -- x, -1)

Let's tay to doon this as a graph:

-> 1 node per variable

→ an edge x: →x; y j>i ⇒xi appears to right of condition sign



 $\# edges = 1+2+-.+n-1 = n(n-1) = {}^{n}C_{2}$  complète gaigh

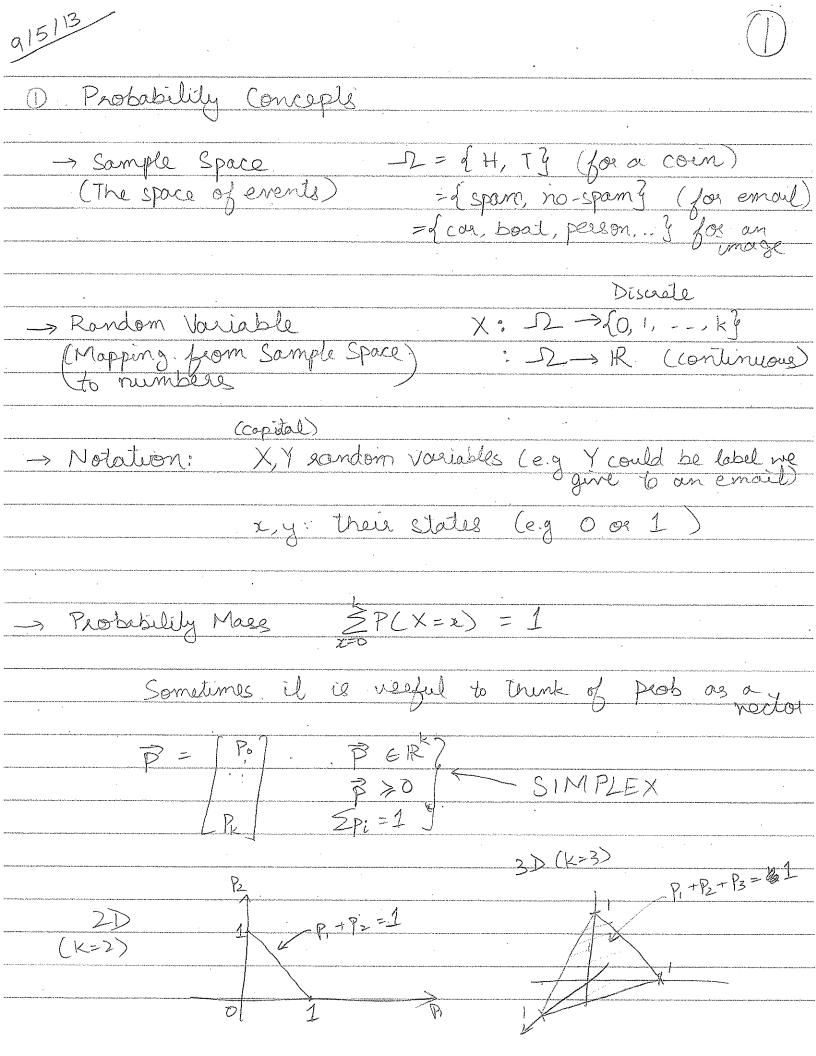
How about a sparse graph?



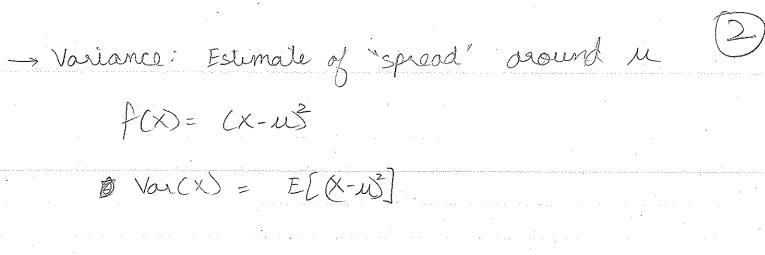
Look familier? Markon Chain!

	. The second of		: [					
(3.2) Ct	rain Re	ule	Vs		Mark	or Ch	oin	:
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For Continuous R.Ys Paob. Density Function $\int p(x) dx = 1$ $p(x) > 0$ $p(x) con be \ \forall 1$ Some Symbol p; Discrete or Continuous, clear from context.
$\mathcal{V}(\mathcal{X})$
$\mathcal{V}(\mathcal{X})$
Some symbol p; Discrete or Continuous, clear from
Same symbol p; Discrete or Continuous, clear from
, CONVAL
-> Expectation of f(x) & some function of R.Y. X
$E_{p}[f(x)] = \frac{2}{x} f(\epsilon) p(x)  \text{Discade}$
Ep[f(X)] =: \(\frac{1}{2}\) f(\(\epsi\)) p(\(\epsi\)) (Discaple)  X=0  \[ \times \text{Weighted} \ \text{Value of } f(\(\epsi\)).
$\int \mathcal{D}_{\lambda} = \langle \lambda \rangle d\lambda$
$= \int f(x) p(x) dx$
<u> </u>
Con think of ELfON] as inner-product (or linear)
for discaste RYs.
100 ms rece 1000
$E[f(x)] = [f(x)] f(x)][f(x)] = \sum_{i=1}^{n} f(x)f(x)$
[ P(K)
-> Mean Value of X under p: Set f(X) = X
$\mathcal{U} = ELXI = 2 \times 2 \times p(x)$
X=0
= 3.5 (for fair dice)



Example:

$$|X| = 0$$
 $|X| = 0$ 
 $|X| = 0$ 
 $|X| = 0$ 
 $|X| = 0$ 
 $|X| = 0$ 

$$M = 0$$

$$Vor(X) = E[X^{2}]$$

$$= (-1)^{2} + 0 + \frac{1^{2}}{3}$$

$$= \frac{12}{3}$$

ANB

$$\neg p(A) = p(A \cap B) + p(A \cap \overline{B})$$
$$-p(A \cap B) \cap p(A \cap B)$$

$$_{\mathcal{R}}$$
  $\rho(A) = \rho(A \cap B) + \rho(A \cap B)$ 

-> Conditional Prob.
P(Y=y   X=x) = P(Y=y, X=x)
P(x=x)
(noin Rule P(X=x, Y=y) = P(Y=y/X=x) P(X=x)
[Recursive Application]
P(X1=21, X2=22, X4=xa, Y=y)=P(X2=22,, Xd=xa, Y=y X=2
$\delta P(X_1 = X)$
= P(Y=y X,=2,, Xd=2d)·P(Xd==2d=/X,=2,, Xd=2d-)
$= P(X_{2}=\lambda_{2} X_{1}=\lambda_{1}) P(X_{1}=\lambda_{1})$
Todoson dance
-> Independence: P(Y=y, X=x) = P(Y=y). P(X=x) / Ty,x
$\frac{1}{2}$
Very Imp!
7
-> COV(X,Y) = E[(X-4x)(Y-4x)
where $u_x = E(x)$ $u_y = E(x)$
Core-(orf (X,Y) = Cov(X,Y)
Voi(X) Vog(Y)

