A discrete random variable (TV) X has probability mass function (PMF) given by p(x): P(x): P(X=x) and the rv is defined X~P(x) When X is the "realized value" and cumulative distribution function (CDF) denoted F(x):= P(X=x)and complementary CDF also called survival function: S(x) := P(X > x) = 1 - F(x)The W has support Supp [x] = {x: p(x) >0, XEIR} and | Supp [X] | \ | IN | i.e. finite or at most countably infinite. sets of this size are called "discrete" The support and the PMF are related via the following identity: > P(x) XE SUPP [X] The most "fundamental" wis the Bernoulli  $X \sim Bern(p) := P^{x}(1-p)^{1-x}, Supp [x] = \{0,1\}$ What if P(T) = p" (1-P)-6 -> ? 4) Tofix this, we introduce the "indicator function" P(x) L> what TE p=1? XN Bern (1) = 1x (1-1) -x Ixe (01) -P(0) = 1001=0 , P(1) = 1001=1 = { 1 > p, 1= Ix=1 This is called a "degenerate" rv. XN peg (1) = {1 w.p.1 XN Bem (0) = Deg (0) = { 0 w.p. 1 Generally, XNDeg(c) = {C W.p. 1= IIx=C P is a "parameter" of the Bernoully rv. What values of P are legal and EX non - degenerate? Soln PE (O11) - This is the parameter space of the Bernoulli. If we have more than one YV X-1, X-2, 111, X-1, we can group them together in a column vector  $\vec{X} = [X_1 \ X_2 \ ... \ X_n]^T$ which has a "join+ mass function" (IMF) defined as

	Px(x) = Px, x2 xn (x1 xn) \( \sum_{\frac{1}{2} \in  \frac{1}{2}} \) Px (x) =		
	X X X X X X X X X X X X X X X X X X X		
	1 V V V V V V V V V V V V V V V V V V V	20 00	
	If X_1,, X_n are independent ru's then the JMF can be factor	$(x_1)$	
	Px(x) = Px(xi) Pxn(xn) the " multiplication rule" = IT Px(xi)		
	If XI Xn are identically distributed denoted XI = Xz = = Xn		
	then $P_{X_1}(x) = P_{X_2}(x) = \dots = P_{X_n}(x) \forall x$ but this affers no simple	rcation of the	
	JMF unless		
	Xi Xn iid denotes		
	F shared PMF "Tudependent and Identically	distributed"	
	$P\vec{\chi}^{(\vec{\chi})} = \vec{\chi} P(\vec{\chi}_{\vec{\lambda}})$		
	$P_{\overline{X}}^{(X)} = \prod_{j=1}^{n} P(X_{\overline{x}})$ $X_{1}, X_{2} \stackrel{\text{iid}}{\sim} Bern(P)  T_{2} := \int (X_{1}, X_{2}) = X_{1} + X_{2} \sim P_{\overline{x}}^{(1)}$	4)	
	$P_{T_2}^{(+)} = P_{X_1}^{(x_1)} + P_{X_2}^{(x_2)}$ $\stackrel{\wedge}{}$ Convolution operator.		
	2 convolution operator.		
L	-> Supp [T2] = {011 m 2}		
	X1 X2		
4	$ \begin{array}{cccc} P & & & & & & & & & & \\ P & & & & & & & & & \\ P & & & & & & & & \\ P & & & & & & & & \\ P & & & & & & & \\ P & & & & & & & \\ P & & & & & & & \\ P & & & & & & & \\ P & & & & & & & \\ P & & & & \\ P & & & \\ P$		
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	(1-P)P		
and the second second second second	$(I-P)^2$		
	$p^2 + 2p(1-p) + (1-p)^2 = (cp) + (1-p)^2 = 1^2 =$	1	
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