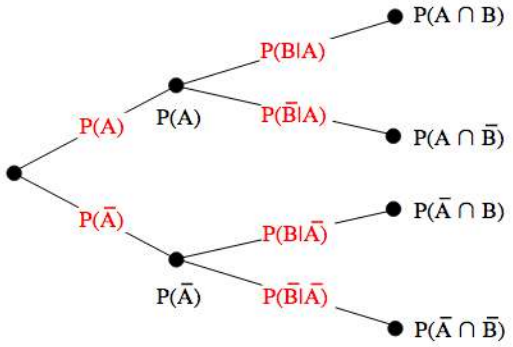
ADM2303 Midterm - Summary Statistics for Management

Statistics for Management (University of Ottawa)

ADM2303 MIDTERM



PROBABILITY

AND $P(A \cap B)=P(A)\times P(B|A)$ IF INDEP. $P(A \cap B)=P(A)\times P(B)$
OR $P(A \cup B)=P(A)+P(B)-P(A \cap B)$ IF DISJOINT $P(A \cup B)=P(A)+P(B)$
GIVEN $P(A|B)=P(A \cap B)/P(B)$
BAYES $P(A|B)=P(B|A)\times P(A)/P(B)$ NOTE: $P(B)=P(B \cap C)+P(B \cap D)$

	C	D	Total
A	$P(A \cap C)$	$P(A \cap D)$	P(A)
B	$P(B \cap C)$	$P(B \cap D)$	P(B)
Total	P(C)	P(D)	1

Contingency Table:
If filled with absolute values, divide each value by the sum of all values, to attain probabilities that altogether total to 1.
Add columns and rows for marginal values.
NOTE: $P(A|C)=P(A \cap C)/P(C)$ ➔ can find conditional probabilities

DISCRETE DISTRIBUTIONS: **INDEPENDENT RANDOM VARIABLES**

$E(X) = \mu = \Sigma x_i \times P(x_i)$ ex. $\mu = (0)(0.25)+(1)(0.5)+(2)(0.25)$ $\Sigma P(x_i) = 1$
$Var(X) = \sigma^2 = \Sigma(x-EV)^2 \times P(x)$ ex. $\sigma^2 = (0-1)^2(0.25)+(1-1)^2(0.5)+(2-1)^2(0.25)$
$SD(X) = \sigma = \sqrt{Var(X)}$ ex. $\sigma = \sqrt{(0-1)^2(0.25)+(1-1)^2(0.5)+(2-1)^2(0.25)}$

$E(X \pm c) = E(X) \pm c$ $E(aX) = aE(X)$ $E(X \pm Y) = E(X) \pm E(Y)$
$Var(X \pm c) = Var(X)$ $Var(aX) = a^2Var(X)$ $Var(X \pm Y) = Var(X)+Var(Y)$
$SD(X \pm c) = SD(X)$ $SD(aX) = |a|SD(X)$ $SD(X \pm Y) = \sqrt{Var(X)+Var(Y)}$ [Like Pythagorean]

NOTE: If payout on policy doubles: $2EV=2\times EV=2\times 200=400$
But if number of policy holders doubles: $EV(X+Y)=E(X)+E(Y)=200+200=400$
The EV is the same, but Var and SD will be different (two policy holders are diff. random variables)

Value	Probability	Expected Value	*[1st step to Var]*	Variance	Standard Dev
x	**P(x)**	**x×P(x)**	**$(x-EV)^2$**	**$(x-EV)^2 \times P(x)$**	
5	2/5	$5(2/5)= 2$	$(5-11)^2 = 36$	$36\times 2/5 = 14.4$	
10	2/5	$10(2/5)= 4$	$(10-11)^2 = 1$	$1\times 2/5 = 0.4$	
25	1/5	$25(1/5)= 5$	$(25-11)^2 = 196$	$196\times 1/5 = 39.2$	**SD:**
	EV:	**$\Sigma x \times P(x)$**	**Var:**	**$\Sigma(x-EV)^2 \times P(x)$**	**$\sqrt{Var}$**
		$2+4+5 = 11$		$14+0.4+39 = 54$	$\sqrt{54} = 7.35$

UNIFORM DISTRIBUTION

$P(x) = 1/n$ $E(X) = n+1/2$ $Var(X) = n^2+1/12$

BINOMIAL DISTRIBUTION

The probability of achieving exactly x successes in n trials

n=sample size | x=number of successes | n-x=number of failures | p=P(success) | q=P(failure)=1-p
$P(x) = \frac{n!}{(n-x)!x!} \times p^x q^{n-x}$ NOTE: $nCx = \frac{n!}{(n-x)!x!}$ $E(X) = np$
$Var(X) = npq$

POISSON DISTRIBUTION

The probability of achieving exactly x successes in a given period of time (or space)

$P(X=x) = \frac{\lambda^x e^{-\lambda}}{x!}$ X = number of successes; λ = mean (expected) number of successes; $EV=\mu=\lambda$; $SD=\sigma=\sqrt{\lambda}$

BAYES THEOREM

The probability that a probability is valid (reverse conditional probability)

Given: P(Faulty), P(1-Faulty=Okay), P(Test Pos|F), P(Test N|F), P(P|O), P(N|O) LF: P(F|P)
BAYES: $P(A|B)=P(B|A)\times P(A)/P(B)$ or $P(F|P)=P(P|F)\times P(F)/P(P)$
Already have top two elements of the equation, just need to find denominator P(P)
Which is made up of $P(P\cap F)+P(P\cap O)$ ➔ $[P(F)\times P(P|F)]+[P(O)\times P(P|O)]$

PLAN, DO REPORT

State Approach
Ex. "Use definition of marginal, joint, conditional probability"
Gen Addition, Gen Multiplication, Complement Rule, Bernoulli Trials, Baye's Theorem

ETHICS

Professionalism: relevance, competence, accuracy, predisposition by investigator, obsolete approach, conflict of interest
Responsibilities in Publications and Testimony: insufficient information (validity, who/why), written in language not intended for audience
Responsibilities of Employers: pressure from employers to provide certain result

VOCABULARY

Cross-Sectional Data: Observed at a fixed time. VS Time Series Data: Ordered data observed over time.
Discrete Variable: Counted items. VS Continuous Variable: Measured characteristics.
Disjoint Events: Mutually exclusive; cannot occur simultaneously, and thus cannot be independent.
Event: Outcome of a trial. VS Trial: Process that produces an outcome.
Independent Event: P(A)=P(A|B), P(B)=P(B|A) OR Check:
Law of Large Numbers: If events are independent, the long-run relative frequency becomes a single value.
Marginal Probability: Single event.
Nominal Values: Name or label. VS Ordinal Values: Non-numeric values, have an order.
Primary Data: You collected the data. VS Secondary Data: Someone else collected the data.
Sample Space: Collection of all exhaustive events, with a combined probability of 1.

VOCABULARY LIST

Complement | Continuous Variable | Cross-Sectional Data | Discrete Variable | Disjoint Event
Empirical Assessment | Event | Identifier Variable | Independent Event | Law of Large Numbers
Marginal Probability | Nominal Value | Ordinal Value | Primary Data | Sample Space | Secondary Data
Subjective Assessment | Theoretical Assessment | Time Series Data | Trial