Date: 21-5

Let's solve some questions, you have to tell which distribution can be used there q.

Q1

- An engineering college has placement rate of 0.3, meaning that any given student has 0.3 chance of ~~prob~~ getting place.
- If you randomly select student what is the probability of student is

1) Placed
2) Not Placed

Ans 1) Placed → 0.3
2) Not Placed → 0.7

- This was solved using Bernoulli distribution when the outcome is Binary { success, failure }
- $Pmf = f(x) = P(X=K) = p^K (1-p)^{1-K}$
- Here $K = \{0, 1\}$ 0 indicates not placed, and 1 → Placed
- p → is probability of success (getting Placed)

Placement Prob = $P(X=1) = (0.3)^1 \times (0.7)^{1-1}$

$= 0.3 \times 1$

Placement Prob = 0.3

Not placed = $P(X=0) = p^0 \times (1-p)^{1-0}$

$= (0.3)^0 \times (0.7)^1$

$= \boxed{0.7}$

Q3 • An engineering college has placement rate of 0.3, meaning any given student has 0.3 chance of getting placed.

• If you randomly select 10 students what is the prob that

1) 9 out of 10 students get placed
2) 3 out of 10 students get placed

Sol 1) 9 out of 10 get placed

• One possible way ⇒ P P P P P P P P P N (P → Placed, N → Not)

• Probability ⇒ 0.3 X 0.3 X 0.3 X 0.3 X 0.3 X 0.3 X 0.3 X 0.3 X 0.3 X 0.7

⇒ $(0.3)^9 \times (0.7)^1$

and there are different combinations as well such as when 1st student not placed other placed

∴ ⇒ No of Combinations = $^{10}C_9$

∴ The ans is ⇒ $^{10}C_9 \times (0.3)^9 \times (0.7)^1$

• In this, you are unknowingly solving question using Binomial distribution

Binomial: defines Binary outcome in n number of independent bernoulli trials.

eq" ⇒ $P \Rightarrow f(x) = P(X=x) = {}^nC_x \, p^x \, (1-p)^{n-x}$

$n \rightarrow$ number of trials $\Rightarrow$ 10
$k \rightarrow$ desired result = 9
$p \rightarrow$ prob of success

$$P(X=9) = {}^{10}C_9 \times (0.3)^9 \times (0.7)^1$$

- As you can see both are same
- It is the probability of 9 out of 10 students get placed

Q3 In an engineering college where any given student has 0.3 chance of getting placed, 0.05 chance of opting out of placement, and 0.65 chance of sitting but not getting placed

- If you randomly select student what is the probability that student :-

1) Gets placed = 0.3
2) opt out = 0.05
3) not placed = 0.65

- It is similar to Bernoulli but here the outcome is not binary
- this distribution is called categorical / multinoulli distribution

Q4 - Same as above
- But in this if randomly select 10 students :-
what is the probability

that :-

1) 3 students get placed, 1 student opts out and 6 students try but not get placed

- given P(Placed) = 0.3
  P(optout) = 0.05
  P(not placed) = 0.65

- ✱ 3 Placed 1 opt out 0 not placed
- 1 possible way how students get placed, opt, not pl. is → PPPONNNNNN
- It's probability = $0.3 \times 0.3 \times 0.3 \times 0.05 \times 0.65 \times 0.65 \times 0.65 \times 0.65 \times 0.65 \times 0.65$

$$= (0.3)^3 \times (0.05)^1 \times (0.65)^6$$

- and there are other combinations of they were placed, not placed, optout

Combinations = $\frac{10!}{3!\,1!\,6!}$ → total

→ Given → 3 Placed, 1 optout, 6 not placed

∴ Probability of 3 Placed, 1 opt out, 6 not placed is

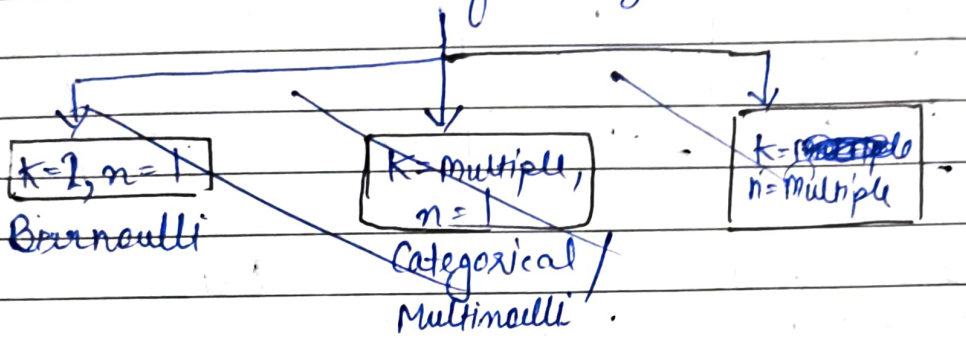
$$= \frac{10!}{3!\,1!\,6!} \times (0.3)^3 \times (0.05)^1 \times (0.65)^6$$

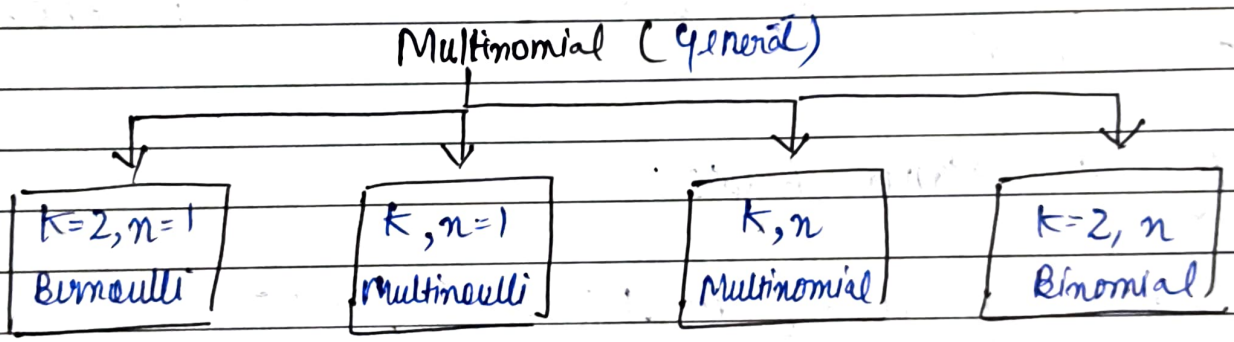
- This distribution is called Multinomial distribution
- In this distribution, the outcome is non binary in fixed number of Multin outi

trials.

- Refer to pdf to see definition of these distributions

- Multinomial is the general case
  ex $n \rightarrow$ number of trials
  $K \rightarrow$ number of categories





- Understanding these distributions is crucial because Naive Bayes types depends on these distributions and logic is based on these distributions

Bernoulli ⟶ Bernoulli naive bayes
Categorical ⟶ Multinoulli / Categorical Naive Bayes
Multinomial ⟶ Multinomial Naive Bayes

Compliment NB - Variant of multinomial for imbalanced Datasets