



Pendahuluan Probabilitas dan Statistika

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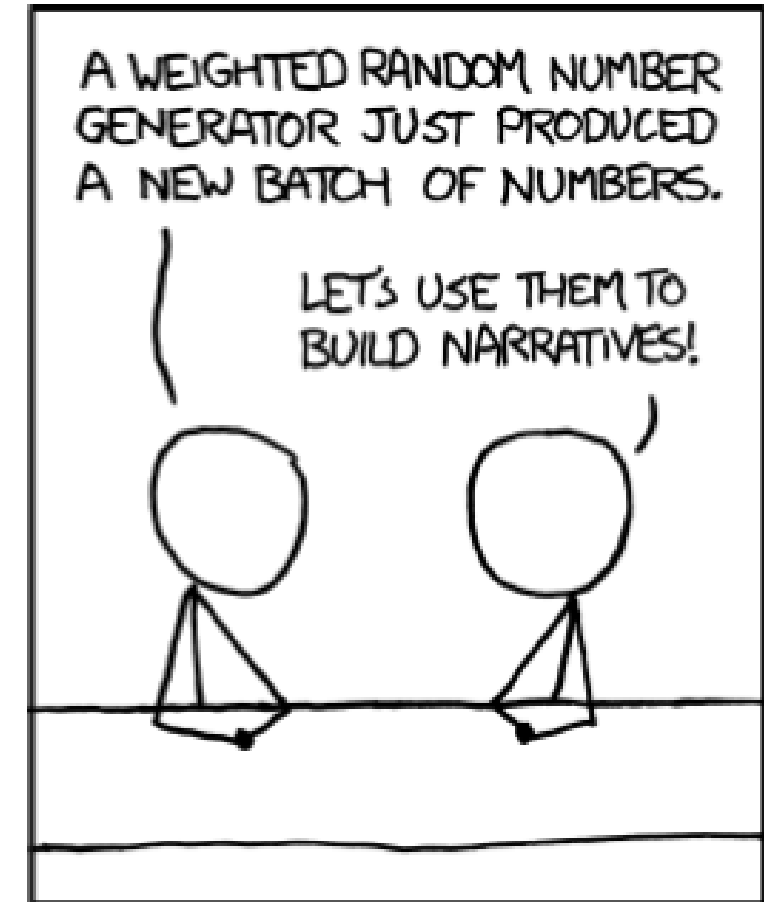
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Outline

1. Definisi
2. Referensi MIT Opencourse Ware
<https://ocw.mit.edu>



ALL SPORTS COMMENTARY

<http://xkcd.com/904/>

Platonic Dice





Probabilitas dan Statistika

- Pelajaran yang berbeda / Ilmu yang berbeda
Keduanya tentang proses acak/random
- **Probability**
 - Logically self-contained
 - A few rules for computing probabilities
 - One correct answer
- **Statistics**
 - Messier and more of an art
 - Get experimental data and try to draw probabilistic conclusions
 - No single correct answer



Counting : Contoh memotivasi

- Berapakah kemungkinan/probabilitas untuk mendapatkan sisi gambar (head) dalam 3 pelemparan coin secara adil/jujur (berimbang)?
- Berimbang => Kemungkinan muncul atau terjadi sisi gambar dan sisi angka di permukaan adalah sama $(1/2) = 0.5$



Poker hand

Deck of 52 cards

- 13 *ranks*: 2, 3, ..., 9, 10, J, Q, K, A
- 4 *suits*: ♥, ♠, ♦, ♣,

Poker hands

- Consists of 5 cards
- A *one-pair* hand consists of two cards having one rank and the remaining three cards having three other rank
- Example: {2♥, 2♠, 5♥, 8♣, K♦}

The probability of a one-pair hand is:

- (1) less than 5%
- (2) between 5% and 10%
- (3) between 10% and 20%
- (4) between 20% and 40%
- (5) greater than 40%



Himpunan-himpunan dalam Kata

Old New England rule: don't eat clams (or any shellfish) in months without an 'r' in their name.

- S = all months
- L = the month has 31 days
- R = the month has an 'r' in its name

$S = \{\text{Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec}\}$

$L = \{\text{Jan, Mar, May, Jul, Aug, Oct, Dec}\}$

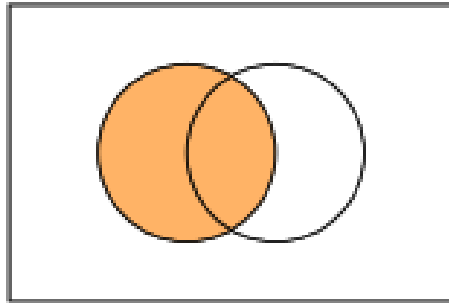
$R = \{\text{Jan, Feb, Mar, Apr, Sep, Oct, Nov, Dec}\}$

$L \cap R = \{\text{Jan, Mar, Oct, Dec}\} = \text{months with 31 days and an 'r'}$

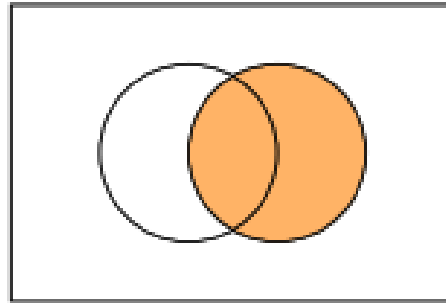
Visualisasi Himpunan dalam diagram Venn



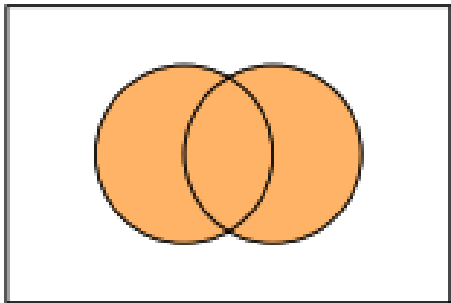
S



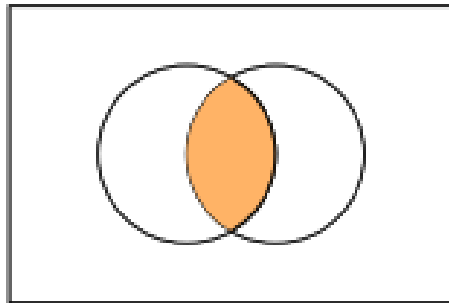
L



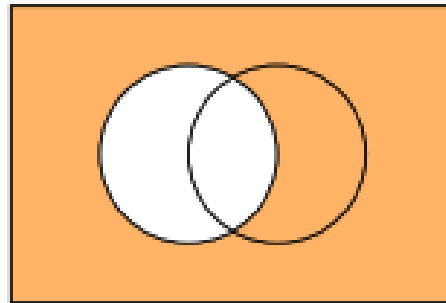
R



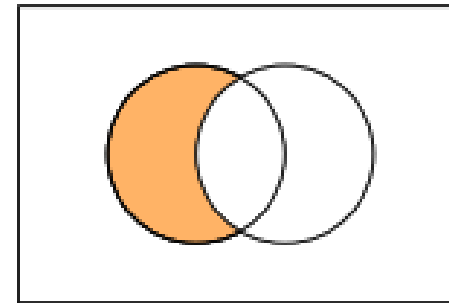
$L \cup R$



$L \cap R$



L^c



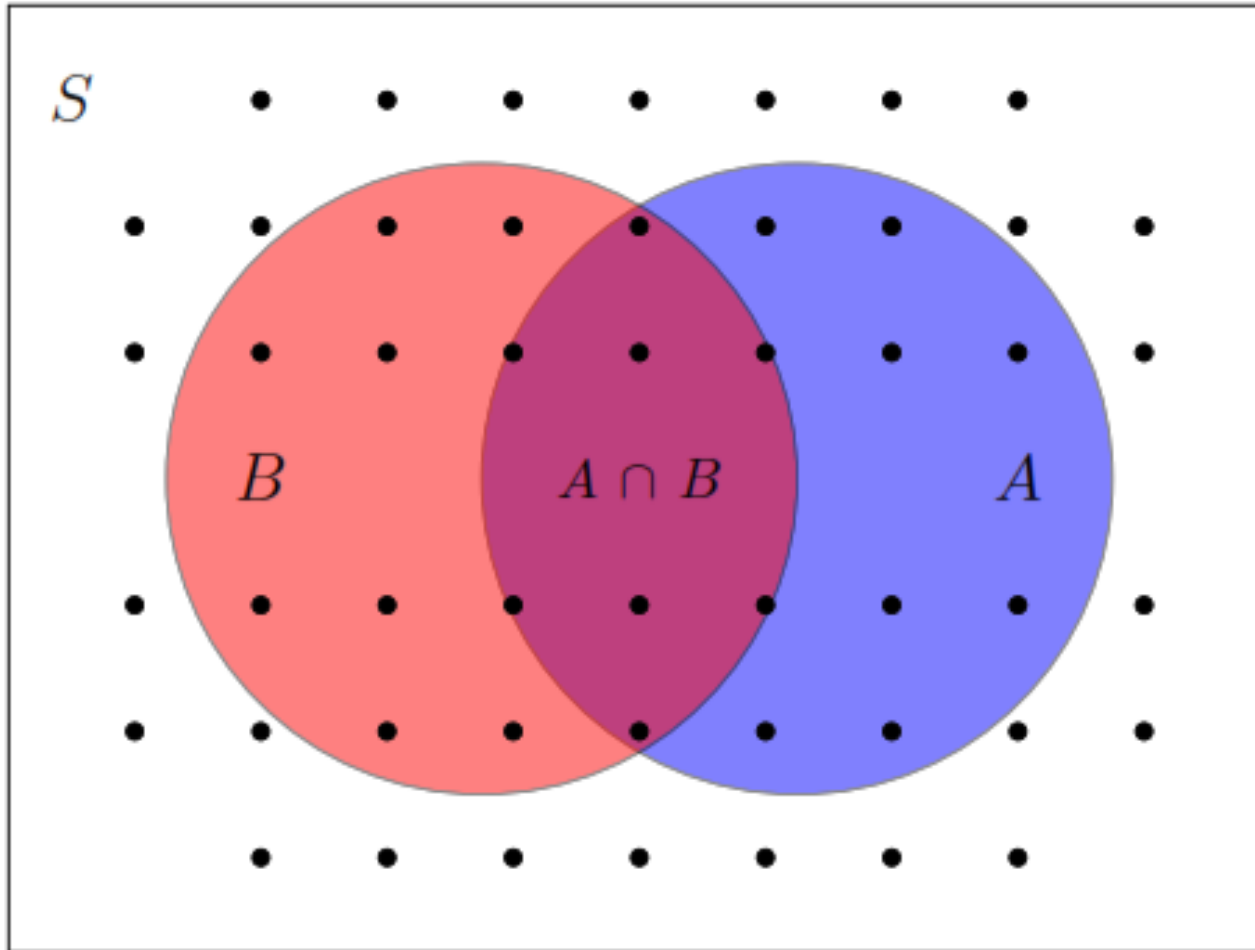
$L - R$



Perkalian Himpunan (Product of Sets)

- $S \times T = \{(s,t)\}$

Prinsip Inklusi dan Eksklusi



Soal



A band consists of singers and guitar players.

- 7 people sing
- 4 play guitar
- 2 do both

How many people are in the band?



Aturan Perkalian

3 shirts, 4 pants = 12 outfits

(More powerful than it seems.)



Pertanyaan Konsep : DNA

DNA is made of sequences of nucleotides: A, C, G, T.

How many DNA sequences of length 3 are there?

- (i) 12 (ii) 24 (iii) 64 (iv) 81

answer: (iii) $4 \times 4 \times 4 = 64$

How many DNA sequences of length 3 are there with no repeats?

- (i) 12 (ii) 24 (iii) 64 (iv) 81

answer: (ii) $4 \times 3 \times 2 = 24$



Soal 1

There are 5 Competitors in 100m final.

How many ways can gold, silver, and bronze be awarded?

answer: $5 \times 4 \times 3$.

There are 5 ways to pick the winner. Once the winner is chosen there are 4 ways to pick second place and then 3 ways to pick third place.

Soal 2

I won't wear green and red together; I think black or denim goes with anything; Here is my wardrobe.

Shirts: 3B, 3R, 2G; sweaters 1B, 2R, 1G; pants 2D, 2B.

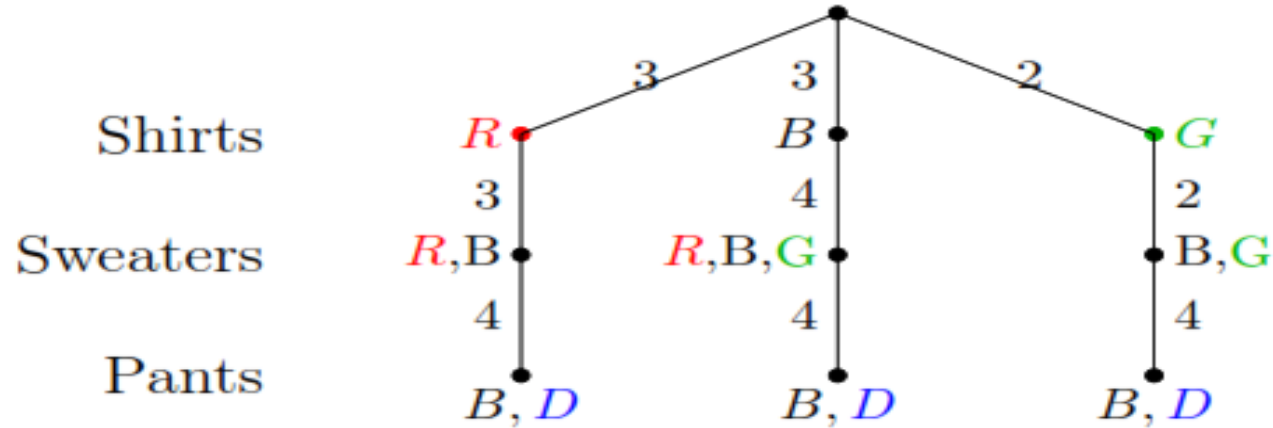


- Deretan diatas adalah kemungkinan pasangan pakaian antara Shirt (kaos), Sweater, dan Celana (Pants)
- Berapa banya pakaian berbeda yang dapat dipakai?

Penyelesaian



answer: Suppose we choose shirts first. Depending on whether we choose red compatible or green compatible shirts there are different numbers of sweaters we can choose next. So we split the problem up before using the rule of product. A multiplication tree is an easy way to present the answer.



Multiplying down the paths of the tree:

$$\text{Number of outfits} = (3 \times 3 \times 4) + (3 \times 4 \times 4) + (2 \times 2 \times 4) = 100$$



Permutasi

- Menyusun barang . Berapakah cara anda melakukan nya?

Lining things up. How many ways can you do it?

'abc' and 'cab' are different permutations of $\{a, b, c\}$



Permutasi (k) dari sebuah Himpunan (n)

Give all permutations of 3 things out of $\{a, b, c, d\}$

abc abd acb acd adb adc
bac bad bca bcd bda bdc
cab cad cba cbd cda cdb
dab dac dba dbc dca dcb

Would you want to do this for 7 from a set of 10?



Kombinasi

- Memilih himpunan bagian.
- Urutan tidak masalah ? Tidak harus urut dalam susunan

Choosing subsets – order doesn't matter.

How many ways can you do it?



Kombinasi (k) dari Suatu Himpunan (n)

Give all combinations of 3 things out of $\{a, b, c, d\}$

Answer: $\{a, b, c\}, \{a, b, d\}, \{a, c, d\}, \{b, c, d\}$



Permutasi dan Kombinasi

abc acb bac bca cab cba
abd adb bad bda dab dba
acd adc cad cda dac dca
bcd bdc cbd cdb dbc dcb

Permutations:

$${}_4P_3$$

$\{a, b, c\}$

$\{a, b, d\}$

$\{a, c, d\}$

$\{b, c, d\}$

Combinations:

$$\binom{4}{3} = {}_4C_3$$

$$\binom{4}{3} = {}_4C_3 = \frac{{}_4P_3}{3!}$$



Soal : Membalik sebuah Coin sebanyak 10 x

(a) Count the number of ways to get exactly 3 heads in 10 flips of a coin.

(b) For a fair coin, what is the probability of exactly 3 heads in 10 flips?

answer: (a) We have to 'choose' 3 out of 10 flips for heads: $\boxed{\binom{10}{3}}.$

(b) There are 2^{10} possible outcomes from 10 flips (this is the rule of product). For a fair coin each outcome is equally probable so the probability of exactly 3 heads is

$$\frac{\binom{10}{3}}{2^{10}} = \frac{120}{1024} = 0.117$$