

Summary on research designs

Nuzul

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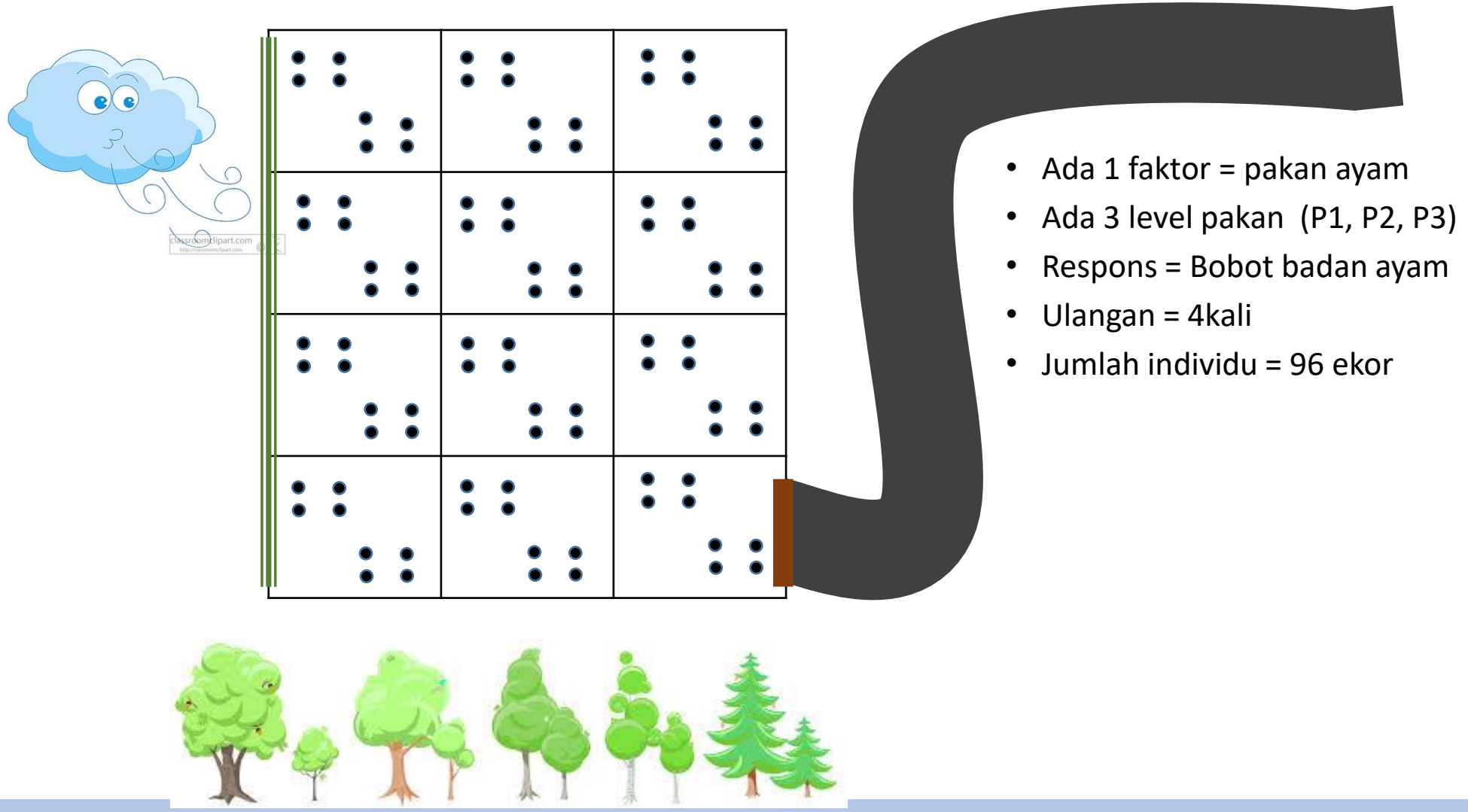
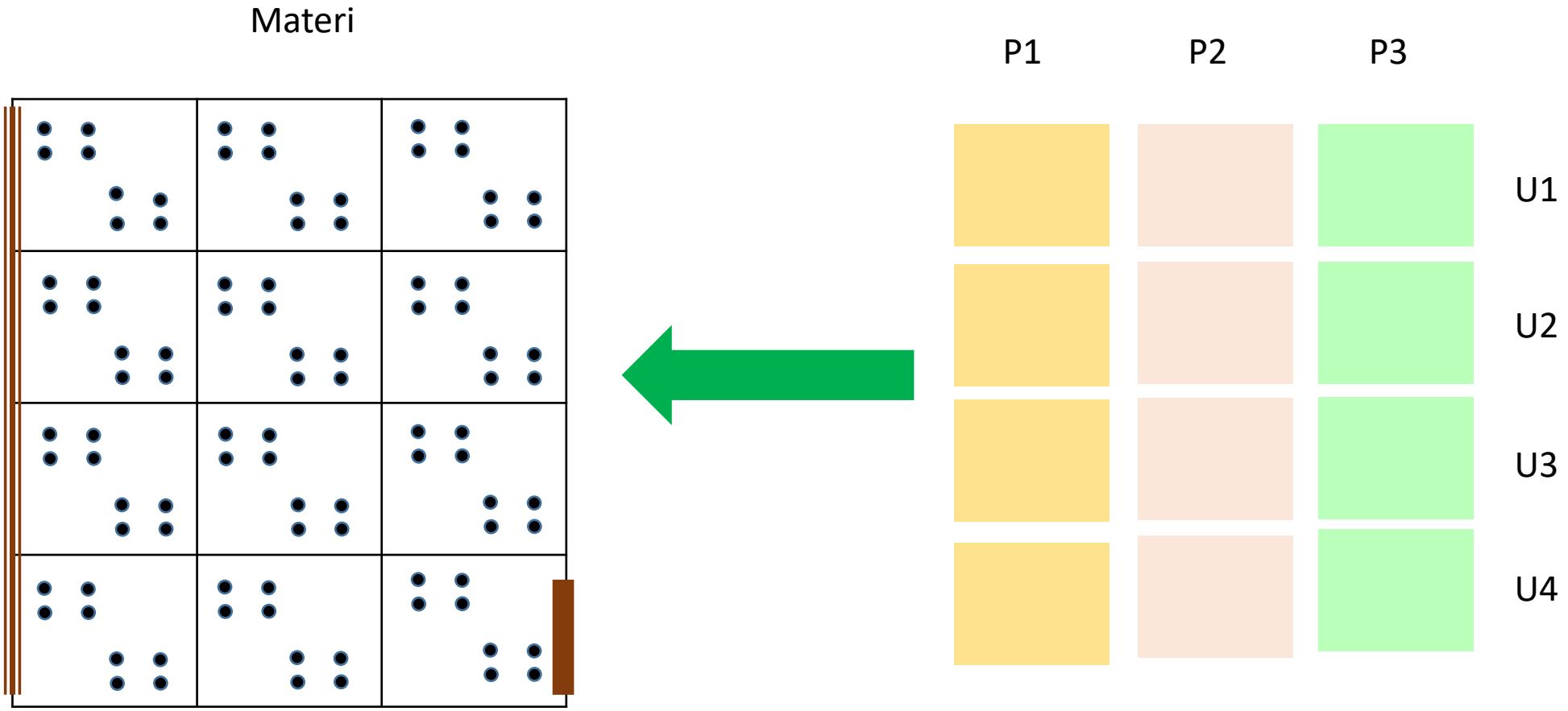
1. Rancangan Acak Lengkap (RAL)



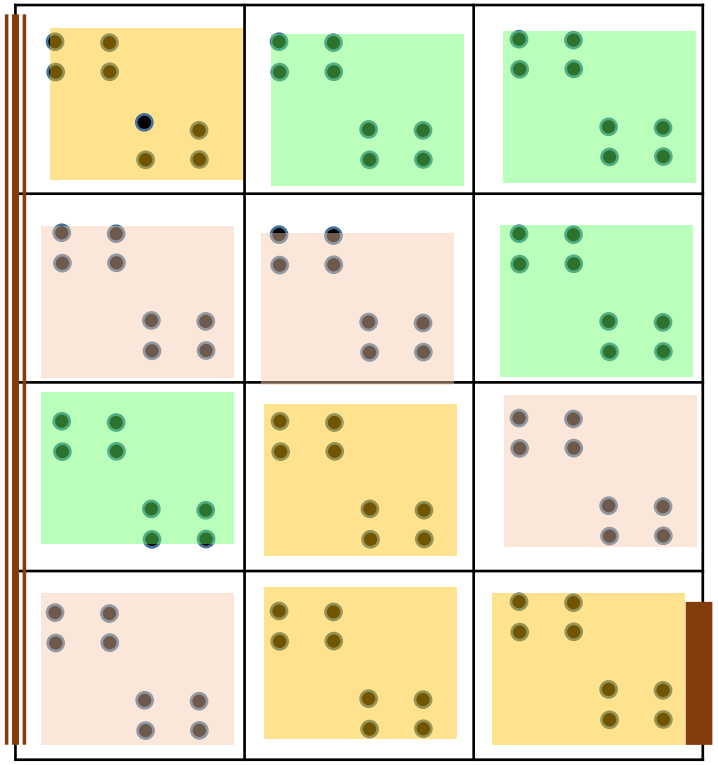
- Ada 1 faktor = pakan ayam
- Ada 3 level pakan (P1, P2, P3)
- Respons = Bobot badan ayam
- Ulangan = 4kali
- Jumlah individu = 96 ekor

RAL: Alokasi materi



Alokasi materi

Materi



- Aloksi materi secara acak ➔ Random
  - Dengan random number
  - Atau undian
- Why?

Model statistik

$$Y_{ij} = \mu + P_i + \varepsilon_{ij}$$

Dimana:
Y = Respons
μ = rerata umum
P = pengaruh perlakuan ke-i
Ɛ = eror dari perlakuan ke-i, unit ke-j
$i \in (1,2,3)$ = Level dari faktor
$j \in (1,2,\ldots,96)$ = individu ayam yang digunakan

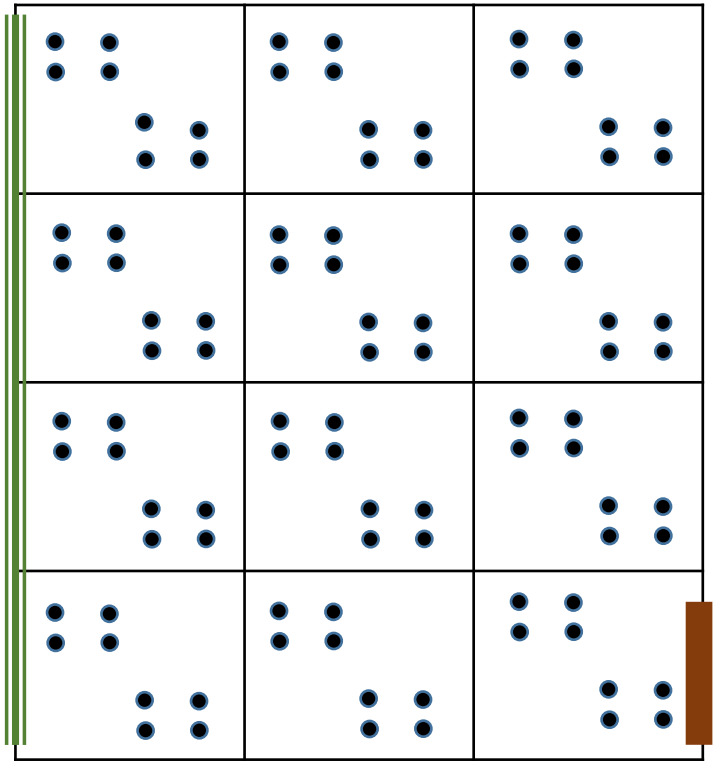
- Ada 1 faktor = pakan ayam
- Ada 3 level (P1, P2, P3)

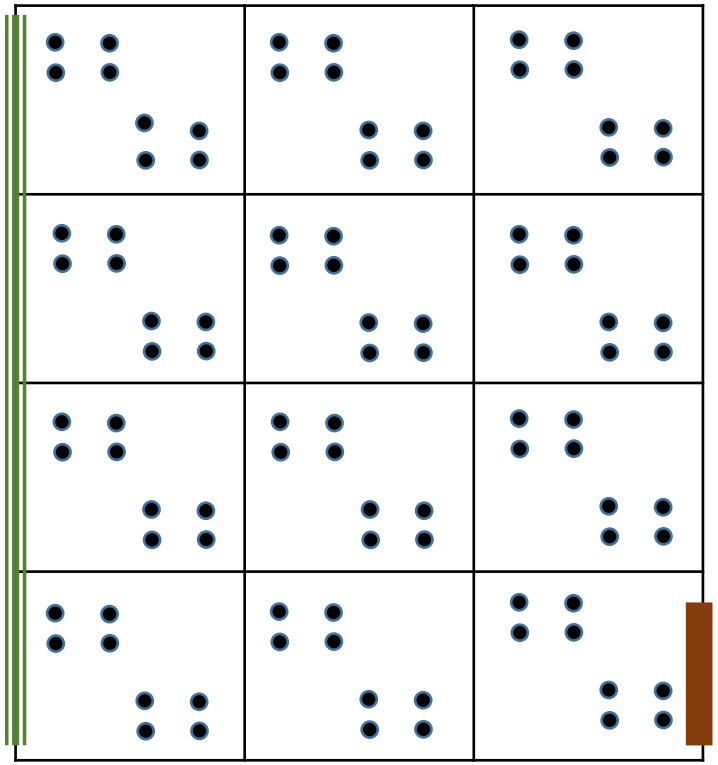
Penelitian membandingkan 3 mean + Cuma 1 faktor:

Analisis data: ANOVA 1 faktor

- Respons = Bobot badan ayam
- Ulangan = 4kali
- Junlah individu = 96 ekor

2. Rancangan acak Kelompok

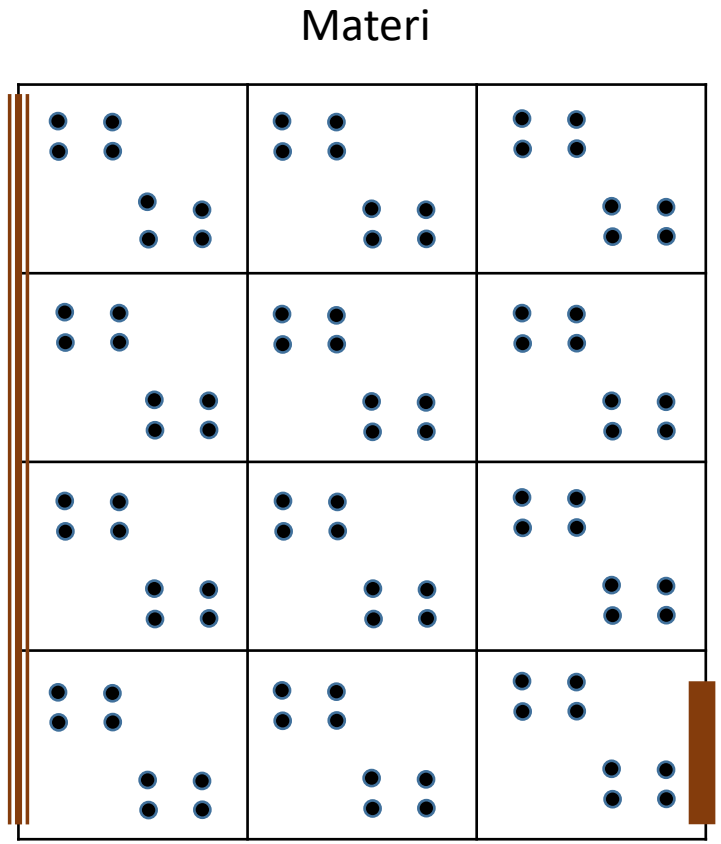


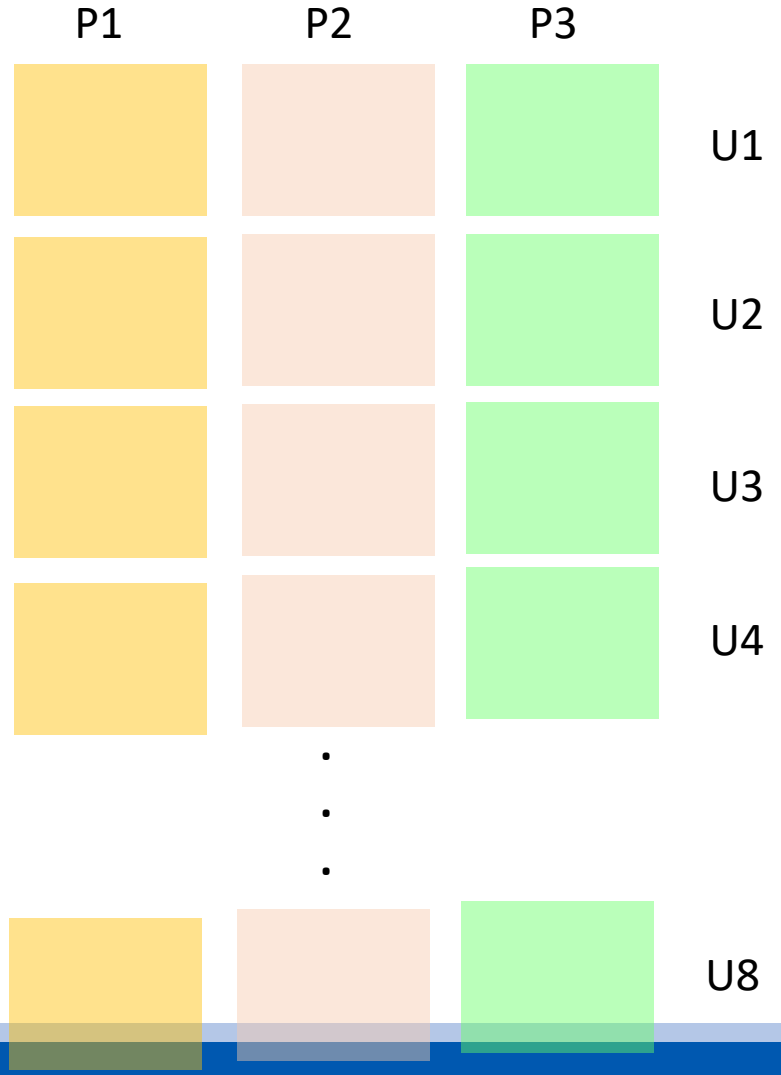


- Ada 1 faktor = pakan ayam
- Ada 3 level pakan (P1, P2, P3)
- Respons = Bobot badan ayam

- Ulangan = 8 kali
- 2 housing yang berbeda
- Jumlah ayam = 192 ekor

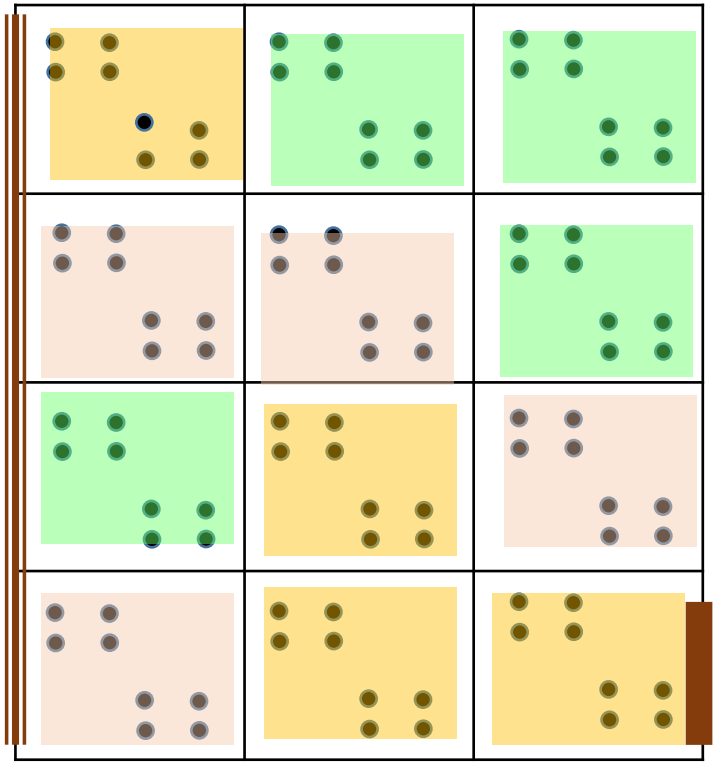
RAK: Alokasi materi



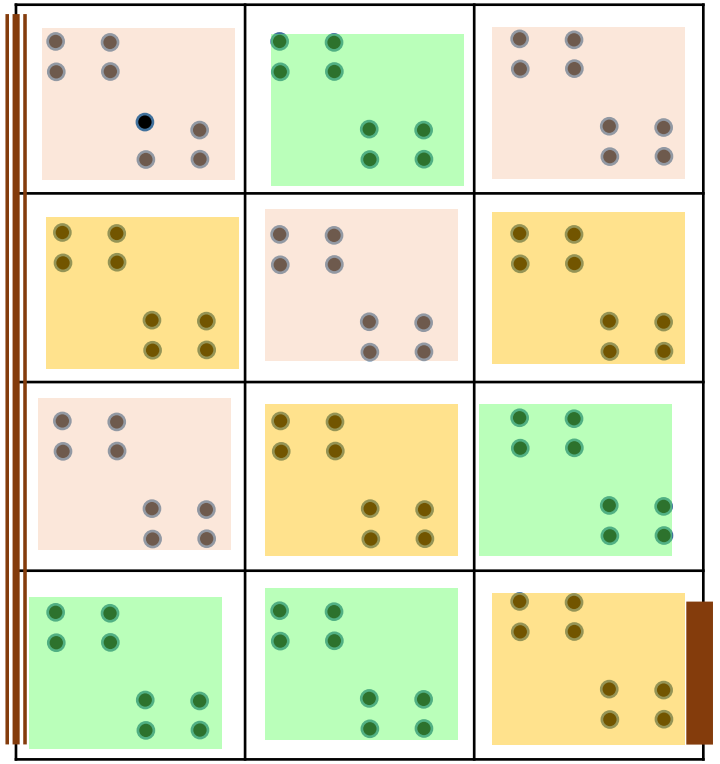


Alokasi materi

Blok 1



Blok 2



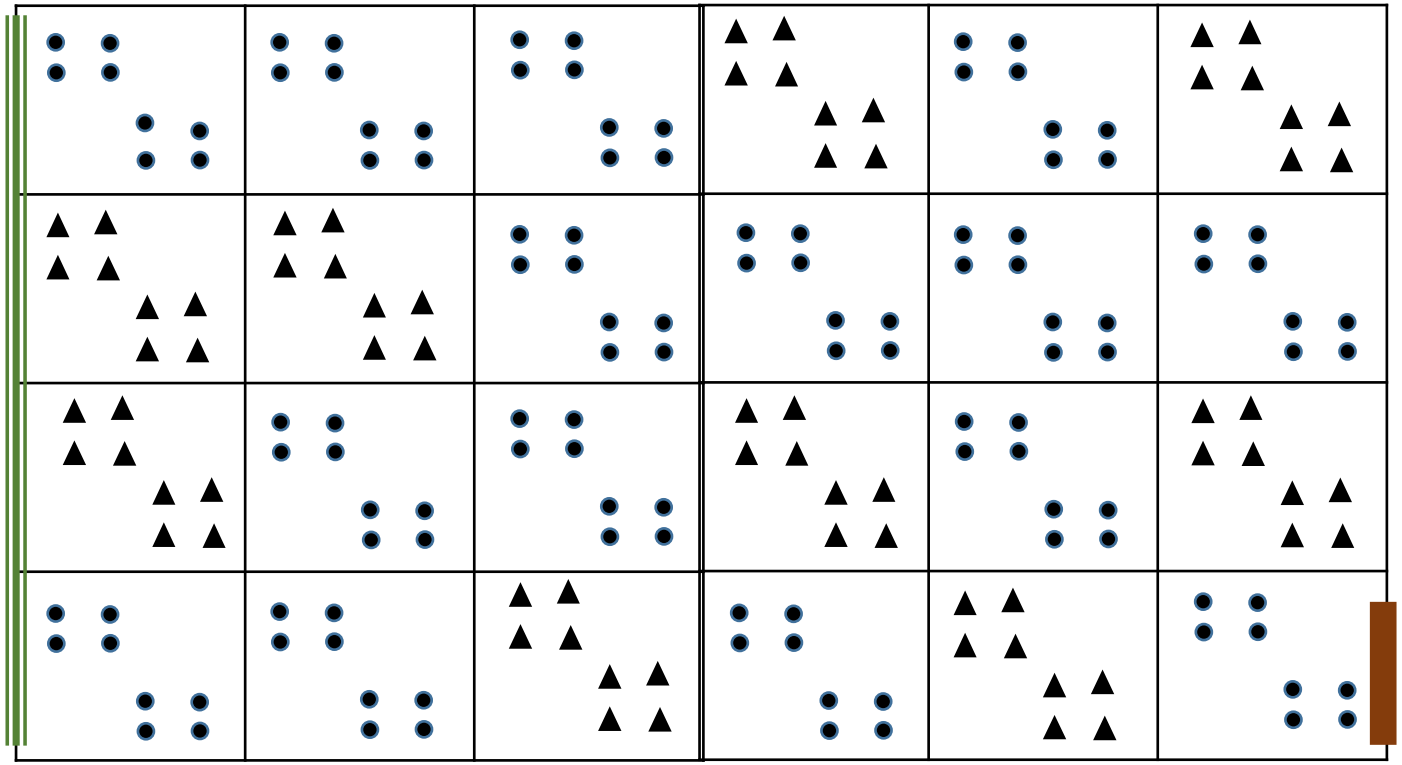
Model statistik

$$Y_{ijk} = \mu + B_k + P_i + \varepsilon_{ijk}$$

ANOVA 2 faktor tanpa interaksi

Dimana:
Y = Respons
μ = rerata umum
B = Blok ke-k
P = pengaruh perlakuan ke-i
Ɛ = eror dari perlakuan ke-i, unit ke-j, blok ke-k
$i \in (1,2,3)$ = Level dari faktor
$j \in (1,2,\ldots,96)$ = individu ayam yang digunakan
$k \in (1,2)$ = jumlah blok

3. Faktorial



- Ada 2 faktor:
  - Pakan ayam
  - Bangsa ayam
- Ada 3 level pakan (P1, P2, P3)
- Ada 2 level bangsa (dot & segitiga)
- Respons = Bobot badan ayam
- Ulangan = 4kali
- Jumlah individu = 192 ekor

*Alokasi materi: Acak

Model statistik

$$Y_{ijk} = \mu + B_k + P_i + B * P_{ik} + \varepsilon_{ijk}$$

ANOVA 2 faktor *dengan* interaksi

Dimana:
Y = Respons
μ = rerata umum
B = Breed ke-k
P = pengaruh perlakuan ke-I
B*P = interaksi breed dengan Pakan
Ɛ = pengaruh eror dari perlakuan ke-i, unit ke-j, blok ke-k
$i \in (1,2,3)$ = Level dari faktor
$j \in (1,2,\ldots,192)$ = individu ayam yang digunakan
$k \in (1,2)$ = jumlah level strain

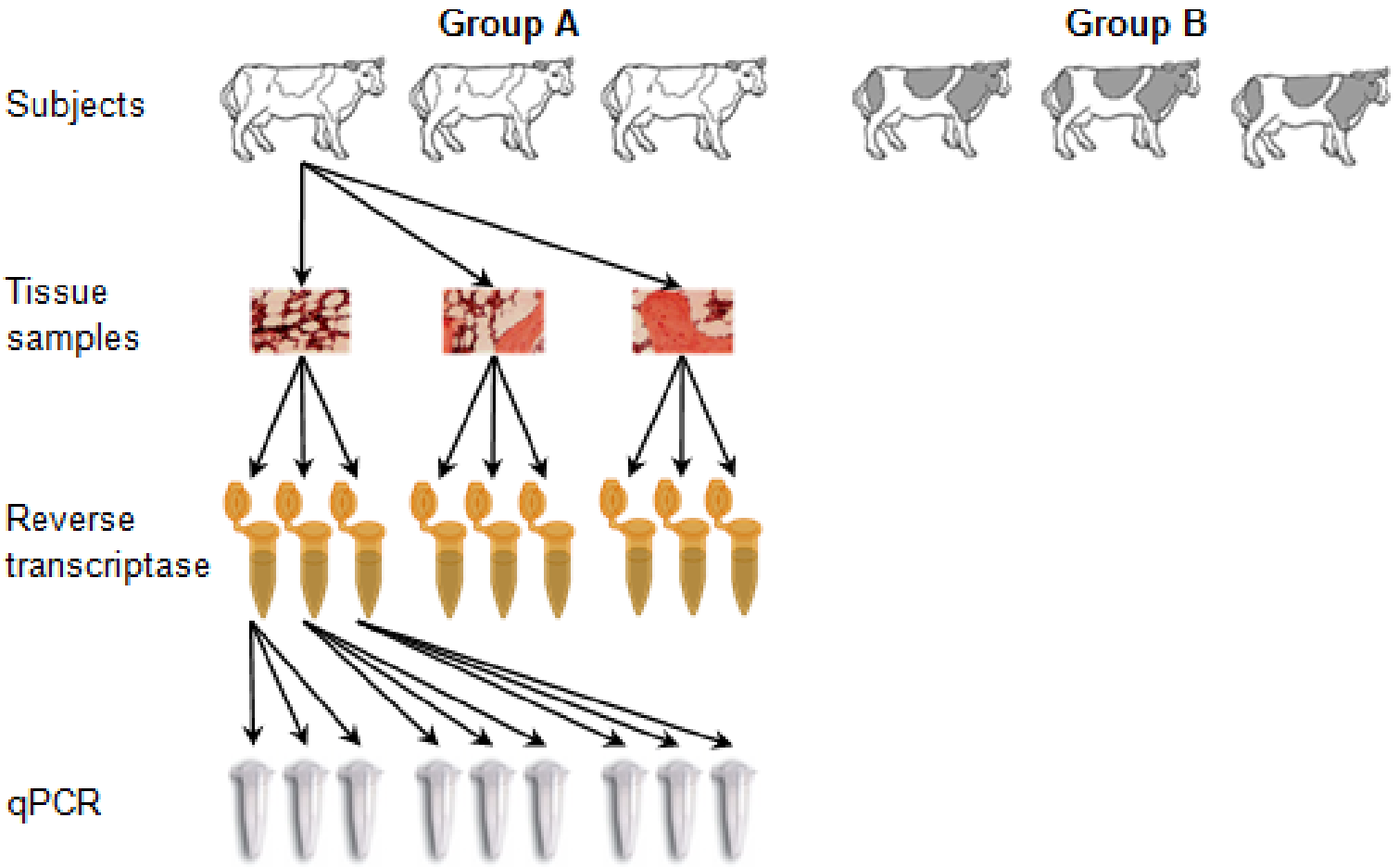
Beberapa jenis rancangan lain

Nested design = pola tersarang

A	1			2			3		
B	1	2	3	4	5	6	7	8	9
	y_{111}	y_{121}	y_{131}	y_{141}	y_{151}	y_{161}	y_{171}	y_{181}	y_{191}
	y_{112}	y_{122}	y_{132}	y_{142}	y_{152}	y_{162}	y_{172}	y_{182}	y_{192}
	y_{11n}	y_{12n}	y_{13n}	y_{14n}	y_{15n}	y_{16n}	y_{17n}	y_{18n}	y_{19n}

- Lebih dari satu factor
- Terdapat hierarki antara factor pertama dan berikutnya

Contoh


Group A
Group B
Subjects
Tissue samples
Reverse transcriptase
qPCR

The model for this design is:

$$y_{ijk} = \mu + A_i + B(A)_{ij} + \varepsilon_{ijk} \qquad i = 1,...,a;\ j = 1,...,b;\ k = 1,...,n$$

where:

y_{ijk} = observation k in level i of factor A and level j of factor B
μ = the overall mean
A_i = the effect of level i of factor A
$B(A)_{ij}$ = the effect of level j of factor B within level i of factor A
ε_{ijk} = random error with mean 0 and variance σ^2
a = the number of levels of A; b = the number of levels of B; n = the number of observations per level of B

Split-plot = petak terbagi

One example of a split-plot design has one of the factors applied to main plots in randomized block design. Consider a factor A with four levels (A_1, A_2, A_3 and A_4), and a factor B with two levels (B_1 and B_2). The levels of factor A are applied to main plots in three blocks. This is a randomized block plan. Each of the plots is divided into two subplots and the levels of B are randomly assigned to them.
One of the possible plans is:

Block 1

B_2	B_2	B_1	B_2
B_1	B_1	B_2	B_1
A_4	A_1	A_2	A_3

Block 2

B_1	B_2	B_1	B_1
B_2	B_1	B_2	B_2
A_2	A_1	A_4	A_3

Block 3

B_2	B_1	B_2	B_1
B_1	B_2	B_1	B_2
A_1	A_2	A_4	A_3

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The model for this design is:

$$y_{ijk} = \mu + Block_k + A_i + \delta_{ik} + B_j + (AB)_{ij} + \varepsilon_{ijk} \qquad i = 1,...,a;\ j = 1,...,b\ ;\ k = 1,...,n$$

where:

y_{ijk} = observation k in level i of factor A and level j of factor B
μ = the overall mean
$Block_k$ = the effect of the k^{th} of block
A_i = the effect of level i of factor A
B_j = the effect of level j of factor B
$(AB)_{ij}$ = the effect of the ij^{th} interaction of A x B
δ_{ik} = the main plot error (the interaction $Block_k$ x A_i) with mean and variance σ^2_{δ}
ε_{ijk} = the split-plot error with mean 0 and variance σ^2

Also, $\mu_{ij} = \mu + A_i + B_j + (AB)_{ij}$ = the mean of ij^{th} A x B interaction

n = number of blocks
a = number of levels of factor A
b = number of levels of factor B

It is assumed that main plot and split-plot errors are independent.

Bujur sangkar latin

	Column 1	Column 2	Column 3	Column 4
Row 1	T1	T4	T3	T2
Row 2	T3	T2	T1	T4
Row 3	T4	T1	T2	T3
Row 4	T2	T3	T4	T1

What is the model? We let:

$$y_{ijk} = \mu + \rho_i + \beta_j + \tau_k + e_{ijk}$$

$i = 1, \ldots, t$

$j = 1, \ldots, t$

$[k = 1, \ldots, t]$ where - $k = d(i, j)$ and the total number of observations

$N = t^2$ (the number of rows times the number of columns) and t is the number of treatments.

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