Group 1 · Case 1 of 4

Four-card group set · work on the case assigned by your instructor

Dairy calves

A livestock nutrition team wants to compare two milk replacers using 24 individually housed calves. The calves arrive in three batches of eight on different days, so transport conditions, age and health could differ among batches and affect growth. Treat each calf as an experimental unit and randomly assign four calves to each milk replacer within every arrival batch.

Design element	Specified value
Experimental unit	Calf
Block	Arrival batch
Reproducibility	Seed 101
Required count check	3 batches × 2 replacers; every count must be 4

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 1 · Case 2 of 4

Four-card group set · work on the case assigned by your instructor

Lambs

A flock manager wants to compare two mineral supplements in 24 lambs. Initial body mass is expected to influence later growth, so the lambs have been placed in four birth-weight bands of six before any treatment is assigned. Each lamb receives its supplement individually; randomly assign three lambs to each supplement within every weight band.

Design element	Specified value
Experimental unit	Lamb
Block	Birth-weight band
Reproducibility	Seed 102
Required count check	4 bands × 2 supplements; every count must be 3

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 1 · Case 3 of 4

Four-card group set · work on the case assigned by your instructor

Goat kids

Researchers want to compare three starter diets in 18 goat kids that were weaned in three cohorts of six. Kids from the same cohort experienced the same weaning date and early management, which may influence later feed intake. Each kid is fed separately, so randomly assign two kids to each starter diet within every weaning cohort.

Design element	Specified value
Experimental unit	Goat kid
Block	Weaning cohort
Reproducibility	Seed 103
Required count check	3 cohorts × 3 diets; every count must be 2

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 1 · Case 4 of 4

Four-card group set · work on the case assigned by your instructor

Piglets

A feeding trial will compare two creep-feed supplements in 24 individually identified piglets. The piglets entered the nursery in four weaning cohorts of six, and differences in age, transport and nursery conditions could produce cohort effects. Give each piglet one supplement and randomly assign three piglets to each supplement within every cohort.

Design element	Specified value
Experimental unit	Piglet
Block	Weaning cohort
Reproducibility	Seed 104
Required count check	4 cohorts × 2 supplements; every count must be 3

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 2 · Case 1 of 4

Four-card group set · work on the case assigned by your instructor

Laying hens

A poultry study will compare three independently controlled lighting programmes in 18 cages. The cages occupy three rack rows of six, and row position may alter temperature, airflow or ambient light. Lighting is applied to the whole cage, so randomly assign two cages to each programme within every rack row.

Design element	Specified value
Experimental unit	Cage
Block	Rack row
Reproducibility	Seed 202
Required count check	3 rows × 3 programmes; every count must be 2

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 2 · Case 2 of 4

Four-card group set · work on the case assigned by your instructor

Broiler pens

Researchers want to compare three litter treatments in a poultry house containing 24 pens. Each treatment is applied to an entire pen, so birds measured within a pen are subsamples rather than separate experimental units. Because ventilation and temperature may differ among four house zones, randomly assign two pens to each litter treatment within every zone.

Design element	Specified value
Experimental unit	Pen
Block	House zone
Reproducibility	Seed 203
Required count check	4 zones × 3 treatments; every count must be 2

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 2 · Case 3 of 4

Four-card group set · work on the case assigned by your instructor

Rabbit cages

An animal-welfare study will compare two cage-enrichment treatments using 16 rabbit cages. The cages are arranged on four rack levels, and height may affect light, temperature and disturbance. Enrichment is installed for each whole cage; randomly assign two cages to each treatment within every rack level.

Design element	Specified value
Experimental unit	Cage
Block	Rack level
Reproducibility	Seed 204
Required count check	4 levels × 2 treatments; every count must be 2

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 2 · Case 4 of 4

Four-card group set · work on the case assigned by your instructor

Tomato pots

A greenhouse experiment will compare three nutrient solutions using 24 separate tomato pots. The pots stand in four bench rows of six, and rows may differ in sunlight and proximity to heating or ventilation. Apply one nutrient solution to each pot and randomly assign two pots to every solution within each bench row.

Design element	Specified value
Experimental unit	Pot
Block	Greenhouse bench row
Reproducibility	Seed 205
Required count check	4 rows × 3 solutions; every count must be 2

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 3 · Case 1 of 4

Four-card group set · work on the case assigned by your instructor

Fish tanks

A fish-nutrition experiment will compare two diets using 16 tanks, with several fish observed in each tank. Diet is delivered to the whole tank, making the tank the experimental unit and the fish within it subsamples. The tanks form four water-system banks that may differ in water conditions, so randomly assign two tanks to each diet within every bank.

Design element	Specified value
Experimental unit	Tank
Block	Water-system bank
Reproducibility	Seed 303
Required count check	4 banks × 2 diets; every count must be 2

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 3 · Case 2 of 4

Four-card group set · work on the case assigned by your instructor

Aquaculture tanks

An aquaculture team wants to compare two feeding schedules in 24 tanks. The tanks are connected to three recirculating-water systems of eight, and each system may have its own water chemistry or flow characteristics. Feeding schedule is assigned to individual tanks; randomly assign four tanks to each schedule within every water system.

Design element	Specified value
Experimental unit	Tank
Block	Recirculating-water system
Reproducibility	Seed 304
Required count check	3 systems × 2 schedules; every count must be 4

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 3 · Case 3 of 4

Four-card group set · work on the case assigned by your instructor

Incubation vessels

A microbiology experiment will compare three inoculation protocols in 18 independently treated culture vessels. Six vessels share each of three temperature-control loops, whose calibration or circulation could influence growth. Apply one protocol to each vessel and randomly assign two vessels to every protocol within each loop.

Design element	Specified value
Experimental unit	Culture vessel
Block	Temperature-control loop
Reproducibility	Seed 305
Required count check	3 loops × 3 protocols; every count must be 2

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 3 · Case 4 of 4

Four-card group set · work on the case assigned by your instructor

Daphnia jars

An aquatic-ecology study will compare three algal diets using 24 independent jars of Daphnia. The jars are held in four water baths of six, and small differences among baths could affect temperature and population growth. Feed each jar one diet and randomly assign two jars to every diet within each water bath.

Design element	Specified value
Experimental unit	Jar
Block	Water bath
Reproducibility	Seed 306
Required count check	4 baths × 3 diets; every count must be 2

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 4 · Case 1 of 4

Four-card group set · work on the case assigned by your instructor

Shelter dogs

A shelter wants to compare two training methods using 24 dogs, with training delivered separately to each animal. Before allocation, the dogs were classified by sex and size because both characteristics may influence behaviour and response to training. The six sex-and-size groups contain four dogs each; randomly assign two dogs to each method within every group.

Design element	Specified value
Experimental unit	Dog
Block	Predefined sex-and-size group
Reproducibility	Seed 404
Required count check	6 groups × 2 methods; every count must be 2

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 4 · Case 2 of 4

Four-card group set · work on the case assigned by your instructor

Horses

An equine study will compare two conditioning programmes in 24 horses. A baseline exercise test was used to form four fitness strata of six because initial fitness is expected to predict improvement. Each horse follows one programme; randomly assign three horses to each programme within every fitness stratum.

Design element	Specified value
Experimental unit	Horse
Block	Baseline-fitness stratum
Reproducibility	Seed 405
Required count check	4 strata × 2 programmes; every count must be 3

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 4 · Case 3 of 4

Four-card group set · work on the case assigned by your instructor

Cats

A nutrition study will compare three diets in 18 individually fed cats. Age may affect metabolism and body-mass change, so the researchers created three baseline-age bands of six before assigning diets. Randomly assign two cats to each diet within every age band so that all diets are represented in each band.

Design element	Specified value
Experimental unit	Cat
Block	Baseline-age band
Reproducibility	Seed 406
Required count check	3 bands × 3 diets; every count must be 2

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks

Group 4 · Case 4 of 4

Four-card group set · work on the case assigned by your instructor

Dairy cows

A dairy trial will compare two feed additives in 24 cows that receive individually measured rations. Milk yield and metabolic response may differ with parity, so the cows were classified into three parity groups of eight before treatment allocation. Randomly assign four cows to each additive within every parity group.

Design element	Specified value
Experimental unit	Cow
Block	Parity group
Reproducibility	Seed 407
Required count check	3 groups × 2 additives; every count must be 4

Produce

- a complete unit table with stable IDs
- a random treatment assignment within every block
- checks of unit uniqueness, overall totals and within-block counts
- a plot that shows block, unit position and treatment
- a 60-second explanation and justification of the restriction and random process

Explain and justify

Question	Notes
Why is this the experimental unit?	
Why could the block affect the response?	
What is fixed by the restriction?	
What remains random?	
What records make the allocation auditable?	

R code and checks