

Statistics and Probability

Two populations, cautious conclusions



Grade 7 • NC.7.SP.4

Teacher guide, original models and student practice

Seven instructional sections • 30 multiple-choice items • 30 open/performance tasks •
Worked keys and evidence records

A multi-session resource bank: select a few tasks for each lesson. Do not assign all 60 in one sitting. Synthetic object data and safe paper-model investigations support reasoning without collecting children's personal information.

Current NC standards for 2026-27 and 2027-28; 2026-adopted standards for 2028-29 are not substituted here.

Free sample | Contents

NC.7.SP.4 | Seventh Grade mathematics

This sample contains 15 complete selected pages from the 88-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-11, 13-14, 66, 76

Representative activities

M01: sample PDF page(s) 11; original page(s) 10

M02: sample PDF page(s) 12; original page(s) 11

O01: sample PDF page(s) 13; original page(s) 13

O02: sample PDF page(s) 14; original page(s) 14

Selected teacher prompts and keys: original page(s) 66, 76

Using this sample

Read the preparation and access guidance before using a selected activity.
Keep teacher keys and private preparation pages separate from student copies.
Use the original resource contents to see the scope of the complete packet.

Complete paid download

The complete resource includes the full PDF task bank and teaching materials.

TEACHER GUIDE

Exact standard and learning targets

NC.7.SP.4 Use measures of center and measures of variability for numerical data from random samples to draw comparative inferences about two populations.

- A • I can use sample centers to compare two populations in context.
- B • I can use sample variability alongside centers to judge a comparison.
- C • I can draw and qualify comparative inferences from random samples.
- D • I can explain how sampling method and repeated evidence affect a comparison.

Essential question: What can data tell us about a population, and what remains uncertain?

Evidence: actual selection records, calculated summaries, original displays and justified interpretations. A correct choice alone does not establish performance in sampling, constructing or explaining.

TEACHER GUIDE

Readiness, access and materials

Prerequisites: distinguish a group from one member; read equal-interval number lines; order data; compute mean and median; use fractions and decimals. For SP.3 and SP.4, teach quartiles using medians of halves and MAD using absolute distances. Calculators may check arithmetic after a learner specifies the method. No fixed speed cutoff is used.

Materials: pencil, ruler, blank paper, optional calculator, 20 equal opaque numbered slips, opaque container and the teacher-only lookup table supplied here. Adults prepare cutting. Digital uniform random integers 1-20 are an alternative, with repeated IDs rejected within a sample. No external accounts, private surveys or purchases are needed.

Access: neutral read-aloud, large print, tactile or enlarged plots, AAC, signed/oral/dictated explanations, and a scribe for the learner's own reasoning are allowed. Preserve the statistical decision: do not choose the sample, name the correct measure, calculate for the learner or identify a correct plot feature during independent evidence collection.

Support log: distinguish access supports from answer-supplying prompts. Modeled or jointly completed tasks are instruction; obtain a fresh individual response later. N/O means unobserved, inaccessible or insufficient evidence, not incorrect. Mark 0 only for an interpretable observed incorrect response.

Vocabulary: population, sample, sampling frame, random, representative, bias, estimate, sampling variation, center, range, MAD, quartile, IQR, overlap and inference. Use home-language explanations and define only words needed for the current task.

Differentiation: reteach with a new smaller data set or a visible complete ID frame; then restore the full task for a fresh check. Extend by changing one extreme value, sample size or selection rule and defending the effect. Do not replace statistical reasoning with memorized definitions.

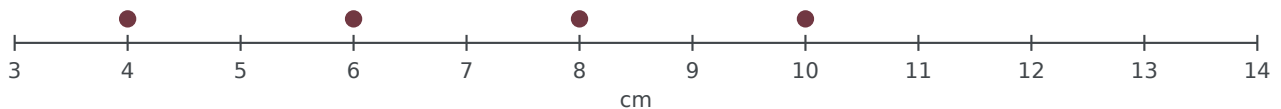
TEACHER-ONLY WORKED MODEL

Compare center with spread and scope

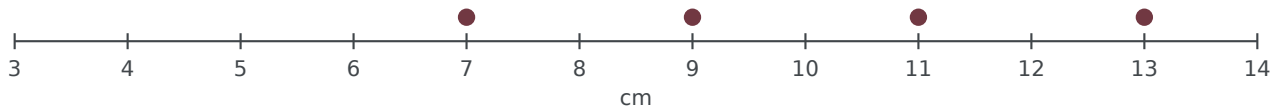
Say: "We randomly select four model strips from each of two complete stock lists. A lengths are 4, 6, 8, 10 cm; B lengths are 7, 9, 11, 13 cm. Means are $28/4=7$ and $40/4=10$ cm. Both have absolute distances 3, 1, 1, 3, so each MAD is $8/4=2$ cm. The sample mean difference B-A is 3 cm, or 1.5 of either MAD. Ranges 4-10 and 7-13 overlap, so B's larger center does not mean every B strip exceeds every A strip. The samples suggest a larger typical B length, with uncertainty. These small samples do not prove the exact population difference."

One dot per sampled strip; common scale

A



B



Ask: What does one mark represent? Which population or data set does the claim address? What cannot be determined from this evidence? Invite an alternative explanation and verify it against the data.

REUSABLE ANCHOR

Connect evidence to the claim

Describe both populations, random sampling methods, measured attribute and units.

Pair center with variability: mean with MAD, or median with IQR when a tail makes a resistant typical-value summary useful.

Compare center gaps relative to within-sample spread, alongside graphical overlap.

A higher sample center does not mean every value is higher or that a population difference is exact.

Repeat fair sampling to examine stability; do not cherry-pick favorable outcomes.

Question / population(s) / attribute and units

Selection method or numerical evidence

Claim / justification / uncertainty

TEACHER GUIDE

Select a core across sessions

Session 1: warm-up, worked model and guided practice (about 35 minutes). Session 2: collaborative and independent work (about 30 minutes). Session 3/conferences: reteach and exit (15+ minutes). Live repeat-sampling or two-plot investigations need another 20-30 minutes. The full bank is reusable across lessons, not an 80-minute test.

Warm-up: M01-M04, O01-O04. Start with M01 and O01; reserve other items for later practice or individual conferences.

I Do: M05-M08, O05-O08. Start with M05 and O05; reserve other items for later practice or individual conferences.

We Do: M09-M13, O09-O13. Start with M09 and O09; reserve other items for later practice or individual conferences.

Collaborative practice: M14-M18, O14-O18. Start with M14 and O14; reserve other items for later practice or individual conferences.

Independent practice: M19-M23, O19-O23. Start with M19 and O19; reserve other items for later practice or individual conferences.

Small-group reteach: M24-M27, O24-O27. Start with M24 and O24; reserve other items for later practice or individual conferences.

Exit ticket: M28-M30, O28-O30. Start with M28 and O28; reserve other items for later practice or individual conferences.

Scoring each dimension separately

Dimensions: selection/design or representation; numerical accuracy; contextual reasoning and uncertainty. 3 = accurate and justified independently; 2 = mostly sound with a limited error or incomplete justification; 1 = partial relevant evidence with substantial gaps; 0 = observed interpretable incorrect response; N/O = unobserved, inaccessible or insufficient evidence. These are instructional descriptions, not official mastery cutoffs.

Keep scores linked to an item and actual evidence. Do not score handwriting, spelling or accent if the statistical meaning is clear. Do not convert N/O to zero. Record access supports and answer-supplying cues separately.

TEACHER-ONLY PREPARATION • KEEP HIDDEN

Run the numbered-object investigations

Use 20 same-size opaque paper slips labeled 1-20 and an opaque container. Adults prepare any cutting. Slips model safe objects; no personal data or physical child measurements are used. Use the printable ID grid on the next page, or write equal slips yourself. Digital alternative: uniform integers 1-20, rejecting repeated IDs within a sample.

Keep the lookup table below hidden. Learners select IDs before you reveal their values. Do not show population totals or values of unselected IDs during an unknown-characteristic investigation. A learner can record your revealed value without handling any real stock. The toy stock is an instructional model, not real measurement evidence.

For each row: mix the full ID pool, draw the specified number without looking, and hold selected slips aside. Read values from this table. Restore all 20 slips and remix before the next row. In paired investigations, use independent draws for A and B; reset each pool. Record actual draws, not desired outcomes.

ID | length A (cm) | length B (cm) | starred status

1: 4 / 6 / star 2: 5 / 7 / plain 3: 5 / 7 / star 4: 6 / 8 / star 5: 6 / 8 / plain

6: 6 / 8 / plain 7: 7 / 9 / star 8: 7 / 9 / plain 9: 8 / 10 / star 10: 8 / 10 / plain

11: 8 / 10 / plain 12: 9 / 11 / star 13: 9 / 11 / plain 14: 10 / 12 / plain 15: 10 / 12 / star

16: 10 / 12 / plain 17: 11 / 13 / plain 18: 11 / 13 / star 19: 12 / 14 / plain 20: 13 / 15 / plain

Teacher check only: pool A mean=8.25 cm; pool B mean=10.25 cm. Starred count=8 of 20, proportion=0.4. These population facts are for validation after inference, never clues during sampling. A census may be revealed at the end to compare estimates with truth.

Audit every row: requested distinct ID count, valid IDs, exact value lookup, no selective omission, correct sum/mean or starred fraction. If generation is inaccessible, mark it N/O and use supplied simulation data only to assess analysis, not actual sampling performance.

TEACHER PREPARATION • PRINTABLE ID SLIPS

Equal slips for a complete frame

Adults may cut along the grid lines. Make all slips identical in size and fold identically so IDs cannot be seen before selection. Keep all 20 IDs in the frame. Grid dimensions are layout aids, not measurement tasks.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20

Optional public roles: selector draws without looking; recorder writes revealed values; checker verifies ID count and reset. Swap roles. Every learner submits their own calculations and inference. Keep the hidden value table with the teacher.

Preparation check / materials substituted / access adaptations

TEACHER MOVES • WARM-UP

Warm-up: evidence and next steps

Selected core: M01 and O01; bank M01-M04, O01-O04. **Suggested 8 minutes.**

Target: Draw and qualify comparative inferences from random samples.

0-2: Name the target population or data set and the unit. 2-5: Use the selected choice item as a low-stakes probe. 5-8: Begin the open task individually, then ask for one reason.

Say: "Which group does the question concern, and what does one recorded value mean?"

Look/listen for: the selected task's population or data interpretation, a method that includes the relevant observations, checked calculation or selection records, and a claim with appropriate limits. Use the full worked key for this specific item.

Respond to misconception: If center alone is used, place the paired plots on one scale and compute a spread for each. If every-object claims appear, compare individual values and identify unobserved members.

Neutral prompt: "Show where that comes from in your record." For an extension, change one sample condition or data value and justify what changes. Record the observed response, support and next step. Longer live performances may continue in a later session.

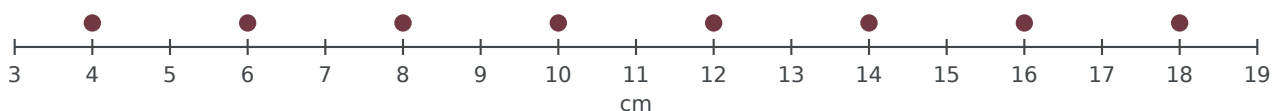
WARM-UP • STUDENT CHOICE PRACTICE

Read, choose, justify

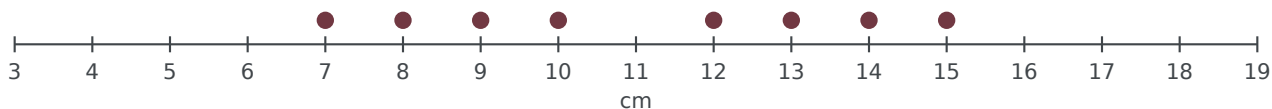
M01 • Target B

Two fictional stocks A and B contain paper tubes. Each stock is independently sampled by a full-inventory random draw of eight distinct objects. The measured length values are in cm. Use the plots. Which conclusion about the sample ranges is correct?

A



B



- A. Both sample ranges are zero.
 - B. A is more variable by range.
 - C. B is more variable by range.
 - D. The sample ranges are equal.
- Evidence / quick check: _____

WARM-UP • STUDENT CHOICE PRACTICE

Read, choose, justify

M02 • Target C

Two fictional stocks A and B contain model ramps. Each stock is independently sampled by a full-inventory random draw of eight distinct objects. The measured height values are in cm. A: [2, 3, 4, 5, 5, 6, 7, 8]. B: [3, 4, 5, 6, 6, 7, 8, 9]. Which is a valid limit on any comparison?

- A. The sample with the largest value has every value larger.
- B. Random samples reveal every unmeasured value.
- C. Different sample means prove a fixed population difference exactly.
- D. These samples support an estimate, not a claim about every object.

Evidence / quick check: _____

M03 • Target B

Independent random samples of delivery times (seconds) are A: [4, 5, 5, 6, 6, 7, 7, 24]; B: [6, 6, 7, 7, 7, 7, 8, 8]. One A value forms a long high tail. Which summary pair is useful for comparing typical times robustly?

- A. Maximum and total
- B. Median and IQR
- C. Largest value only
- D. Range and sample count only

Evidence / quick check: _____

WARM-UP • STUDENT PERFORMANCE

001 • Make your thinking visible

Target C • Draw and qualify comparative inferences from random samples.

Two fictional stocks A and B contain paper strips. Each stock is independently sampled by a full-inventory random draw of eight distinct objects. The measured length values are in cm. A: [5, 5, 6, 6, 6, 6, 7, 7]. B: [1, 3, 5, 6, 6, 7, 9, 11]. Compute both means and MADs. Write a comparative inference that uses the center difference and spread, in context, with a sampling limitation.

Set A: data / center / variability calculations

Set B: data / center / variability calculations

Comparison / evidence / limitations

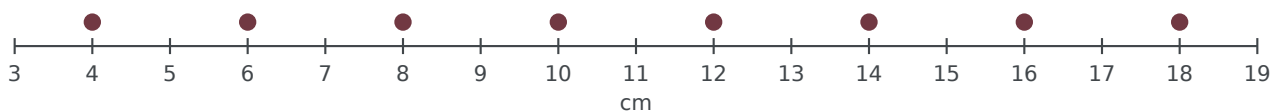
WARM-UP • STUDENT PERFORMANCE

002 • Make your thinking visible

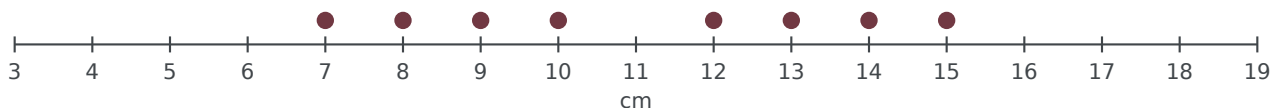
Target B • Use sample variability alongside centers to judge a comparison.

Two fictional stocks A and B contain paper tubes. Each stock is independently sampled by a full-inventory random draw of eight distinct objects. The measured length values are in cm. Use the same-scale plots to compute both medians and IQRs. Describe overlap/separation and make a cautious comparison of the stocks.

A



B



Set A: center and spread evidence

Set B: center and spread evidence

Comparison / limitation

TEACHER-ONLY WORKED KEYS

Check method, values and inference

M01 • Answer B: A is more variable by range.

A range=14, B range=8 cm. A larger center is not automatically greater variability.

Distractors: A: Both samples have multiple distinct values. C: Recompute each maximum-minus-minimum before comparing. D: Recompute each maximum-minus-minimum before comparing.

M02 • Answer D: These samples support an estimate, not a claim about every object.

Interpret centers and variability together, retain the sampling context, and qualify the inference. Population values remain partly unobserved.

Distractors: A: One endpoint does not order all observations. B: Random selection does not observe every member. C: Sampling variation affects the difference.

M03 • Answer B: Median and IQR

A median=6, IQR=2; B median=7, IQR=1 seconds. The median/IQR focus on the center and middle spread, less affected by the high endpoint than mean/range.

Distractors: A: Maximum and total do not provide a robust typical-time comparison. C: One endpoint hides typical values and variation. D: Neither gives a center.

TEACHER-ONLY WORKED KEYS

Check method, values and inference

O01 • Sample response / required evidence

A: Mean= $48/8=6$. Absolute distances: 1, 1, 0, 0, 0, 0, 1, 1. Their sum is 4; MAD= $4/8=0.5$. B: Mean= $48/8=6$. Absolute distances: 5, 3, 1, 0, 0, 1, 3, 5. Their sum is 18; MAD= $18/8=2.25$. Mean A-B=0 cm. Sample means match. Use these as evidence about typical stock values, while acknowledging overlap/variation and that another sample could differ. Do not claim every A object exceeds every B object.

O02 • Sample response / required evidence

A: Ordered data: 4, 6, 8, 10, 12, 14, 16, 18. Lower half: 4, 6, 8, 10; upper half: 12, 14, 16, 18. Q1=7; Q3=15; IQR= $15-7=8$. B: Ordered data: 7, 8, 9, 10, 12, 13, 14, 15. Lower half: 7, 8, 9, 10; upper half: 12, 13, 14, 15. Q1=8.5; Q3=13.5; IQR= $13.5-8.5=5$. Medians A=11, B=11 cm. Observed ranges A 4-18, B 7-15. These ranges overlap. The representative random design supports a tentative stock comparison; the samples do not reveal the full population ranges.

O03 • Sample response / required evidence

Verify six observed draws: three from each pool, each of five distinct IDs, with full reset between rounds and correct value lookup. Require a justified center (mean or median) paired with variability (MAD, range or IQR), calculated for each observed sample. Discuss direction and stability of the three comparisons, overlap and uncertainty. Teacher pool B is a shifted population, but students must infer from their samples, not be told the shift. Exact estimates vary. If draws are not observed, mark collection N/O and assess the plan separately.