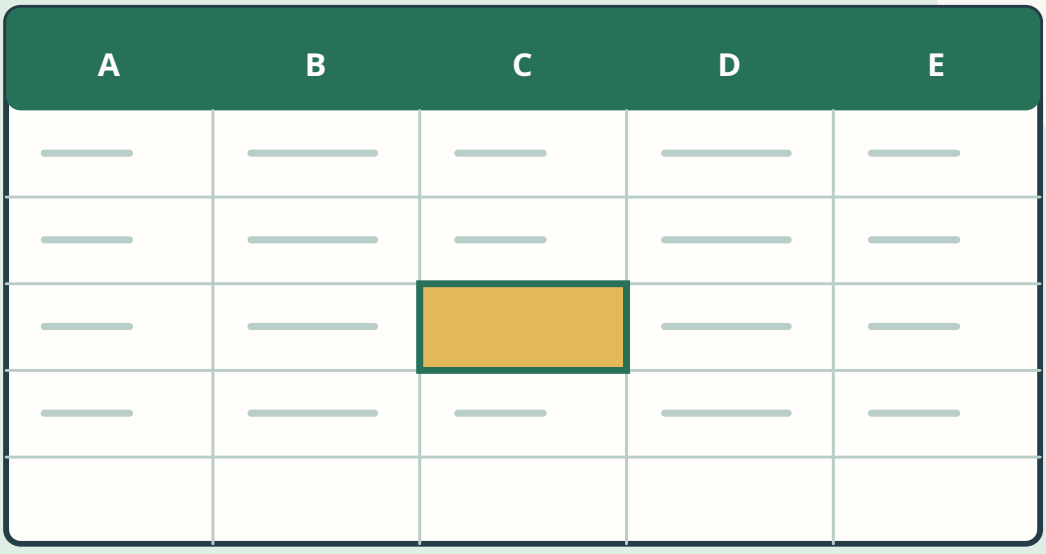
CONDITIONAL SPREADSHEET TOTALS

Calculating Conditional Totals in Spreadsheets



CONDITION / TOTAL

Calculating Conditional Totals in Spreadsheets

Learning outcomes

- Write six conditional total formulas using aligned ranges.
- Explain how repeated rows and blanks affect the stated totals.
- Reconcile formula outputs to a manual inclusion list.
- Separate row membership, numeric contribution, and completeness for conditional sums.
- Construct fixed-range selector and matrix SUMIFS formulas with aligned source populations.
- Preserve raw duplicate occurrences, blank categories, zero amounts, and signed adjustments under explicit policies.
- Use numeric boundaries, literal and wildcard criteria, and overlap-aware OR totals.
- Reconcile disjoint partitions and verify controlled source and range changes without fabricating missing values.

Audience: General workplace learners using synthetic practice materials

Setup

Use only the supplied fictional records. Do not access real accounts, visit practice URLs, change live permissions, execute downloads, or submit messages. For spreadsheet exercises use a blank local practice workbook with English Excel formula names and comma separators; some regional installations use semicolons. Keep raw inputs and worked outputs separate.

Study the foundations, work through the applied units, complete the practice tasks, and then attempt the assessment. Use only the supplied fictional practice data. Keep your original inputs and your revised work separate.

Core concepts

State the unit and inclusion rule

The dataset is a raw log of document-production units. Each row contributes its numeric Units value if its department and type satisfy the requested condition. The exercise deliberately includes a repeated R01 row. The task is raw-row totals, not deduplicated totals, so include both rows and flag the duplicate separately. A blank Units value is missing data, not evidence of a verified zero, even though it contributes no numeric amount to SUMIFS. These rules must be stated before calculating; otherwise two different totals may both look reasonable.

Build SUMIFS from aligned ranges

SUMIFS places the sum range first, followed by pairs of criteria range and criterion. For example, =SUMIFS($D$2:$D$15,$B$2:$B$15,"Ops",$C$2:$C$15,"Guide") adds Units only where both the department and type match. Every range must refer to corresponding rows and have the same dimensions. Shifting one criteria range down by one row can associate a unit value with the wrong department. Lock the dataset ranges when copying summary formulas so the data window does not drift.

Distinguish text criteria and missing fields

Text criteria such as "Guide" require quotation marks when written directly into a formula. A criterion can instead refer to a selector cell. Use "" to target blank department cells in this controlled dataset. Blank type rows do not match Guide or Form and therefore remain outside type-specific summaries. A numeric zero, such as R10, is a real supplied value and can be included without increasing a total. Do not replace missing amounts with invented zeroes simply to make the table look complete.

Reconcile by listing included rows

For each summary, list the row positions or IDs it includes and add the values independently. Duplicate IDs make row numbers important: “R01 twice, at worksheet rows 2 and 13” is unambiguous. Reconcile department totals against the full raw Units total, and record categories excluded by the six requested summaries. Do not add all six summary results and expect the raw total because the summaries overlap. The Form total overlaps department-specific Form totals, so summing summary rows would double-count some data.

Worked example

In a separate four-row log, Ops/Guide has 4 units, Ops/Form has 6, HR/Guide has 5, and Ops/Guide has 3. The Ops-and-Guide total is 4+3=7, not 18 and not 13. Write =SUMIFS(D2:D5,B2:B5,"Ops",C2:C5,"Guide"). The function tests both conditions on each corresponding row. As an independent check, mark the two included rows and add them manually. If a blank amount appears on a matching row, record that completeness issue even though the numeric sum itself can still be calculated.

Foundation practice

Layout

A1:D1 = RecordID, Department, Type, Units. Enter all fourteen records in A2:D15 in order. For [blank], leave a genuinely empty cell.

Rows

- 2: R01; Department=Ops; Type=Guide; Units=10
- 3: R02; Department=Ops; Type=Form; Units=5
- 4: R03; Department=HR; Type=Guide; Units=8
- 5: R04; Department=IT; Type=Guide; Units=12

- 6: R05; Department=Ops; Type=Guide; Units=7
- 7: R06; Department=HR; Type=Form; Units=4
- 8: R07; Department=IT; Type=Form; Units=6
- 9: R08; Department=Ops; Type=Form; Units=[blank]
- 10: R09; Department=Ops; Type=[blank]; Units=3
- 11: R10; Department=HR; Type=Guide; Units=0
- 12: R11; Department=IT; Type=Guide; Units=9
- 13: R01; Department=Ops; Type=Guide; Units=10
- 14: R13; Department=[blank]; Type=Guide; Units=2
- 15: R14; Department=HR; Type=[blank]; Units=1

Six requested totals

- Ops and Guide
- Ops and Form
- HR and Guide
- IT and Guide
- All departments and Form
- Blank department and Guide

Data policy

Include every supplied raw row, including both R01 entries. Do not silently deduplicate. Flag missing Units on R08 separately. Blank department/type do not inherit the previous row’s label.

Foundation tasks

- Write the six formulas and a manual check listing all included row numbers.
- Explain the effect of the repeated R01 and distinguish R08 missing Units from R10 numeric zero.
- Capstone: provide a raw total and a department reconciliation, then explain why adding the six overlapping summaries is not a valid reconciliation.

01 Define exactly what the total represents

A conditional total combines two decisions: which rows belong and what numeric contribution each selected row makes. Before choosing a function, write both decisions in ordinary language. In the fictional Harbor Materials desk, each source row is a logged movement of printed materials. Department and Type describe the movement. Units is a signed quantity, with a positive number adding materials and a negative number recording a supplied return adjustment. The requested measure is net logged units, not the number of transactions, distinct requests, or physical items currently on a shelf.

Import assets/material_movements.csv at A1 on a sheet named Materials. Its sixteen records occupy A2:D17 with headers RecordID, Department, Type, Units. The file contains one repeated M01 record, one missing Units value, one numeric zero, blank category fields, and one negative adjustment. These features are intentional. Keep the original file unchanged. A conditional-sum exercise must explain their effects instead of deleting difficult rows until the arithmetic looks tidy.

The policy is raw-row inclusion. Every supplied row is eligible to contribute, including both copies of M01. A repeated identifier is a review flag, not permission to deduplicate. An empty Units field is genuinely missing, not a measured zero. A blank department or type stays blank and does not inherit the label from the row above. These are local case rules, not claims that every organization's reporting policy should behave the same way.

Use Excel 2016 or later with SUMIFS support, including Microsoft 365. Examples use English function names, decimal points, and comma argument separators. Adapt separators or localized function names if your installation requires it, while preserving the ranges and conditions. CSV files do not preserve workbook formulas or reliably establish cell types, so check that nonblank Units values are numbers and that D9, the amount for M08, is truly empty. Save your working file as a workbook rather than overwriting the CSV.

Separate three possible outputs in your explanation. A numeric subtotal reports the sum of available numeric contributions. A membership list identifies every row that satisfies the labels. A completeness statement reports whether every matching row supplies a usable amount. A single number cannot represent all three. For example, a subtotal can be mathematically correct for observed amounts while the full amount for the selected population remains unknown.

The automated companion checks independently enumerate row membership and add signed integers. They do not execute your workbook in Excel. Formula syntax, import typing, and recalculation in your application must be checked separately. Keep this distinction visible in your practical record: expected values come from deterministic arithmetic, while observed workbook values come from the file you constructed. Agreement between the two is meaningful evidence only when the populations and data types also agree.

E01-X1 Define exactly what the total represents — application

Create Materials from the supplied CSV. Identify the exact cells containing the duplicate identifiers, missing amount, numeric zero, negative adjustment, and blank department. Write a one-sentence measure definition and state the source range.

Submit: An input audit with cell addresses, a population definition, and the distinction between a subtotal and completeness.

02 Build a membership ledger before a formula

Start with the question 'How many net units are logged for Ops Guide movements?' This is not a count of matching rows. A row belongs only if Department is Ops and Type is Guide at the same worksheet position. Read the complete source once and list the positions that pass both tests. In Materials, worksheet rows 2, 6, and 13 meet the rule. Their amounts are 12, 8, and 12, so the subtotal is 32. Both M01 occurrences contribute because the policy is raw rows.

A membership ledger can be a short record rather than a second full copy of the dataset. Record worksheet row, RecordID, the two tested labels, amount state, and contribution. For the selected example, all three amounts are numeric and present. A ledger that says only 'M01 and M05' is ambiguous because M01 occurs twice. Include row positions or another stable occurrence identifier whenever the supplied key is not unique.

Apply the same reasoning to Ops Form. Rows 3 and 9 match. Row 3 contributes 7, while row 9 has a missing amount. The available numeric subtotal is 7, but the membership ledger has two selected rows and one unresolved contribution. Do not remove row 9 from the membership list merely because it adds no number. Selection and contribution are separate stages. This distinction makes the later completeness note explainable instead of appearing as an unrelated warning.

A manual check should be independent of the formula's structure. Repeating the same SUMIFS in another cell does not test whether the intended rows were selected. Reading the labels and adding the corresponding supplied values creates a different route to the answer. For a small training dataset, write the actual included positions. For a large operational dataset, another reconciliation method may be needed, but it must still test the population rather than duplicate the same possible mistake.

Use exclusion reasons selectively. You do not need to write a long explanation for every nonmatching record, but choose near-misses that test the rule. M02 is Ops but Form, so it must not appear in Ops Guide. M03 is Guide but HR, so it also stays out. These two contrasting records prove that both conditions matter. A rule that accidentally implements Ops or Guide would include them and produce a larger, different population.

Keep the selected-row ledger in the same source order as the CSV during the lesson. Sorting the worksheet without updating row references can make a previously correct audit look inconsistent. If you deliberately sort a working copy, record that change and use an occurrence marker that moves with the record. The course examples preserve source order so their exact cell references remain reproducible across learners and instructors.

A ledger should distinguish an excluded row from an included row with no numeric contribution. Consider row 11, HR Guide with Units 0, and row 9, Ops Form with missing Units. For an HR Guide query, row 11 is selected and contributes a known zero, while row 9 is excluded because its labels fail. For an Ops Form query, row 9 is selected with an unknown contribution, while row 11 is excluded. The same source row can therefore have a different reporting role under a different query. Do not create a permanent Included flag without

naming the query it belongs to. A query-specific ledger avoids confusing a data-quality state with a category membership decision.

E02-X1 Build a membership ledger before a formula — application

Create independent ledgers for Ops Guide, Ops Form, and IT Form. Include worksheet positions, IDs, signed amounts or missing state, numeric subtotal, and completeness. Name one near-miss for Ops Guide.

Submit: Three membership ledgers and one explicit exclusion example.

03 Translate the ledger into SUMIFS arguments

SUMIFS begins with the range to add, followed by pairs consisting of a criteria range and a criterion. For Materials, the amount range is $D$2:$D$17. The department range is $B$2:$B$17, and the type range is $C$2:$C$17. The Ops Guide expression is =SUMIFS($D$2:$D$17, $B$2:$B$17, "Ops", $C$2:$C$17, "Guide"). Read it as 'add these Units where the corresponding Department is Ops and the corresponding Type is Guide.'

The literal text criteria are inside quotation marks. The range references are not. Writing "B2:B17" would supply text rather than a range reference. Writing Ops without quotes would be interpreted as a name rather than the literal department label, unless a separate defined name happened to exist. Use explicit quoted labels in the first examples so the distinction between an address and a criterion is easy to see.

One SUMIFS with two criteria pairs implements simultaneous conditions on each row. It does not add an Ops subtotal to a Guide subtotal. It does not search for Ops in one row and Guide in a different row. The matching positions are where both tests are true together. This is why the manual Ops Guide ledger contains only rows 2, 6, and 13 rather than every Ops row and every Guide row.

For all departments' Form units, omit the department pair rather than inventing a department wildcard. The expression is =SUMIFS($D$2:$D$17, $C$2:$C$17, "Form"). Its numeric subtotal is 16, including the negative IT adjustment and excluding the missing numeric contribution while still requiring a completeness warning. A one-condition SUMIFS is valid and keeps the same sum-range-first pattern as the multi-condition examples.

SUMIF is a related function with a different argument order: SUMIF(criteria_range, criterion, sum_range). For a single department, =SUMIF($B$2:$B$17, "IT", $D$2:$D$17) and =SUMIFS($D$2:$D$17, $B$2:$B$17, "IT") both express the IT total in this dataset. Do not change only the function name and leave the arguments in their old order. The function choice does not repair a wrong measure definition.

After entering a formula, compare three things: the formula text, the numeric result, and the membership ledger. If the result differs, inspect argument roles before changing the source values. A common mistake is placing the department range in the sum position, which cannot represent a total of Units even if the expression is syntactically accepted. Another is omitting one pair and silently broadening the population. Explain the exact mismatch rather than calling the function unreliable.

Consider a near-correct formula that swaps the criteria ranges but not the labels: =SUMIFS($D$2:$D$17, $C$2:$C$17, "Ops", $B$2:$B$17, "Guide"). Its ranges have the right dimensions and endpoints, but it searches Type for Ops and Department for Guide. It returns 0 in this source because neither category assignment exists. The repair is not to add wildcard characters or change the data. Restore the intended range/criterion pairs. A useful formula review names each pair aloud: Department equals Ops; Type equals Guide. This catches role swaps that a row-boundary check alone cannot find. Structural alignment, field meaning, and criterion meaning all need to agree.

E03-X1 Translate the ledger into SUMIFS arguments — application

Write SUMIFS expressions for Ops Guide, IT Form, and all Form movements. Also write equivalent SUMIF and SUMIFS expressions for the IT department total. Match each formula to its independently established population.

Submit: Five formula records, expected numeric results, and a completeness note where needed.

04 Audit alignment, not only equal range lengths

SUMIFS ranges must have the same dimensions, but equal size is not the complete alignment requirement. $D$2:$D$17 and $B$3:$B$18 both contain sixteen cells. They are nevertheless paired one row out of step. The amount from worksheet row 2 would be tested against the department in row 3, and the last amount against a cell below the dataset. A formula may therefore return a number without faithfully evaluating the source records.

Use a separate AlignmentLab with A1:C1=Department, Type, Units and four rows: row 2 Ops/Guide/4, row 3 HR/Form/9, row 4 Ops/Form/6, row 5 IT/Guide/3. The correct Ops Guide total is 4 from row 2 only. =SUMIFS($C$2:$C$5, $A$2:$A$5, "Ops", $B$2:$B$5, "Guide") expresses the correct aligned selection. If the department range shifts to A3:A6 while the type range remains B2:B5, no row satisfies both tests and the result becomes 0.

The zero in that broken example is not evidence that the source contains no Ops Guide movement. It is evidence of a different, unintended pairing. Trace the first pair explicitly: C2=4 is tested against A3=HR and B2=Guide. Trace the next pair: C3=9 is tested against A4=Ops and B3=Form. This positional audit shows why the expected record disappears. Merely checking that every range contains four cells would miss the defect.

Different-sized ranges are a separate structural problem. A sum range D2:D17 with a criteria range B2:B16 has mismatched dimensions and should be corrected rather than hidden with a blanket error replacement. A formula that reports 0 after masking an error is not equivalent to a valid conditional subtotal of 0. Keep structural failures visible until the ranges are repaired and the relevant membership check has been repeated.

For every formula, inspect the first row, last row, column role, and number of rows for every range. The sum range and each criteria range should describe the same source population in the same order. Headers should stay outside the ranges. A total row should also stay outside unless the task explicitly defines it as a source record, which this course never does. The check is about correspondence, not cosmetic rectangularity.

Copying summary formulas creates another alignment risk. If all source ranges are relative, filling the summary down can advance them to rows 3:18, then 4:19, gradually dropping early records and including empty cells. Fix dataset endpoints when the source window is meant to remain constant. Leave only the selector references relative as needed. This makes the summary's changing question independent of the source population being queried.

A shifted sum range can be equally misleading. In AlignmentLab, use =SUMIFS($C$3:$C$6, $A$2:$A$5, "Ops", $B$2:$B$5, "Guide"). The label tests correctly select the first position, but the first amount position is now C3, containing 9 from the HR Form record. The result is 9 rather than 4. This is a plausible positive total with perfectly matching range lengths. The error demonstrates why the amount range must be audited as carefully as the criteria ranges. Trace the selected position across every argument, not merely the label columns. After repairing C3:C6 to C2:C5, repeat both the formula inspection and the manual contribution check.

E04-X1 Audit alignment, not only equal range lengths — application

Recreate AlignmentLab and explain the correct 4 versus shifted 0 results using row pairings. Then inspect Materials formulas for matching starts/ends and describe the difference between a same-sized shift and a differently sized range.

Submit: A four-row alignment demonstration and a range-audit record.

05 Use selectors as explicit report inputs

A selector cell changes the question without changing the source data. On Materials, put F1=Department selector, G1=Type selector, H1=Selected net units. Enter F2=Ops and G2=Guide. In H2, use =SUMIFS($D$2:$D$17, $B$2:$B$17, F2, $C$2:$C$17, G2). This formula reads the contents of the selector cells. Do not put quotation marks around F2 or G2, because that would test for literal text resembling an address rather than the chosen labels.

Copy the selector row down for three independent requests: F3=Ops, G3=Form; F4=IT, G4=Guide; F5=Finance, G5=Guide. Fill H2 through H5. The source ranges remain anchored, but F2 and G2 advance to the selectors on each summary row. The expected numeric outputs are 32, 7, 26, and 0. The second output is incomplete because of the missing Ops Form amount. The last has no matching source rows, which is different from a selected row that supplies zero.

A blank selector is not automatically an instruction to include every category. In this course, blank-department questions use an explicit empty-string criterion in a separately labeled formula. If a report needs an All departments option, define its behavior and use a formula that omits the department condition. Do not assume that deleting the selector text changes an equality test into an unrestricted query. An ambiguous selector can make a correct formula answer the wrong question.

Labels should tell the reader what the selectors mean. Department selector and Type selector are report inputs; they are not new source records. Keep the summary to the right of the source, not below the source in rows that a later range extension might accidentally

include. If the selected result has a completeness warning, place the note beside that result so it is not separated from the number during a handoff.

Use a selector-change test as an inexpensive audit. Change F2 from Ops toIT while G2 stays Guide. H2 should change from 32 to 26, and the included rows should change from 2, 6, 13 to 5, 12. The source data and every other selector row should remain unchanged. Restore F2=Ops. If H3 changes instead, or H2 remains 32, inspect the selector reference and whether the cell contains a formula rather than a pasted answer.

The purpose of selectors is controlled reuse, not hiding criteria. A reviewer should be able to read the selector values and determine the question being answered without editing the formula. Keep a stable formula pattern and record any permitted category labels. A misspelling can produce a valid no-match zero, so a zero output still needs a membership check when it is unexpected. Do not silently replace a misspelled label with a similar one unless the source policy authorizes that change.

A report request should preserve its own identity when selectors change. If F2 changes from Ops toIT, the heading beside H2 must still communicate the current selector values rather than retain a manually typed label Ops Guide. A numerically correct 26 under a stale Ops Guide label is misleading. For this exercise, you can place the selectors visibly beside the subtotal instead of constructing a separate dynamic sentence. The source dataset remains unchanged; the question changed. In the test log, record both the selector value and the resulting membership. That record distinguishes a legitimate query change from a source-data revision and lets another reader reproduce the earlier 32 without guessing.

E05-X1 Use selectors as explicit report inputs — application

Build the four selector requests at F2:H5. Record each formula, numeric subtotal, membership state, and completeness. Run the F2 Ops-to-IT change and restore it. Explain why an empty selector is not an All option.

Submit: A four-request summary and a restored selector-change test.

06 Build a department-by-type total matrix

A matrix exposes the intersection of two category dimensions. On a sheet named Summary, enter Department in A1, Guide in B1, Form in C1, and Poster in D1. Put Ops, HR, IT in A2:A4. The source remains on Materials. Each interior cell should add Units for its row department and column type. This is a conditional-total matrix, not a multiplication table, so each result must be derived from the source records rather than from marginal totals.

The seed in B2 is =SUMIFS(Materials!$D$2:$D$17, Materials!$B$2:$B$17, $A2, Materials!$C$2:$C$17, B$1). The dataset ranges are fully anchored. $A2 keeps the department-selector column fixed while allowing the department row to change. B$1 keeps the type-selector row fixed while allowing the type column to change. Fill B2:D4 and inspect opposite corners as well as the seed.

The resulting row values are Ops 32, 7, 10; HR9, 5, 0; IT26, 4, 0. The zero Poster results for HR andIT are no-match intersections, while HR Guide contains a real zero record alongside a positive record. The same displayed 0 can therefore represent different populations. Keep

completeness separate too: Ops Form 7 includes one missing amount. A nine-cell matrix of numbers does not convey that qualification by itself.

Summing the nine displayed cells gives 93, not the raw numeric total 102. This is expected because the matrix covers only three named departments and three named types. It excludes blank-type amounts 4 and 2, and blank-department Guide amount 3. The missing categories account for the difference 9. A matrix is a complete partition only when its axes cover every source category exactly once, including any intentionally retained blank categories.

Do not represent the blank department by typing the word Blank into a selector and expecting it to match an empty cell. Blank is then a literal category label that does not appear in the source. Use a separately labeled formula with criterion "" for the blank bucket. Similarly, the blank-type bucket needs its own explicit condition. Labels shown to a reader and criteria passed to a function may need different representations.

Inspect a copied formula such as Summary!D4. It should use $A4 forIT and D$1 forPoster while keeping the Materials ranges at rows 2:17. If the ranges moved or the selectors stayed at the seed, the matrix may repeat plausible numbers. A row/column total reconciliation and a formula-pattern check catch different defects, so perform both. The matrix should remain a live report when one source amount or one selector changes.

E06-X1 Build a department-by-type total matrix — application

Build Summary!B2:D4 from one seed. Report all nine values, the copied D4 formula, the matrix total, and the exact excluded category amounts needed to reconcile to the raw numeric total.

Submit: A formula-bearing matrix and a reconciliation that retains the missing-amount warning.

07 Retain duplicate occurrences under the stated policy

Duplicate-looking rows are often a data-quality concern, but the requested calculation determines how to handle them. Materials contains M01 twice with Ops, Guide, 12 at worksheet rows 2 and 13. Under the supplied raw-row policy, both contribute. The Ops Guide subtotal 32 includes 12+8+12. A deduplicated total would answer a different question and would require a separate decision about which occurrence to retain and why.

An identifier alone is not sufficient evidence that two rows represent an accidental duplicate. In another setting, the same request might legitimately generate several movements. The fictional case tells you to flag the repetition but not delete it. Your job is to preserve that distinction: the calculation uses every raw row, while the note reports that the repeated identifier may need later review. Do not let a quality concern silently rewrite the population.

Quantify the effect without changing the source. If one of the identical M01 occurrences were excluded in a separate what-if calculation, Ops Guide would fall from 32 to 20, Ops total from 53 to 41, Guide total from 70 to 58, and raw numeric total from 102 to 90. Those differences

all equal 12 because the same source row belongs to each of those overlapping summaries. This explains the impact of the policy without treating the hypothetical result as the authorized report.

The duplicate note should name positions as well as the repeated ID. 'M01 at rows 2 and 13 is retained twice under raw-row reporting' is precise. 'Duplicates cleaned' is not, because it does not reveal whether rows were removed, merged, or merely flagged. If the worksheet is sorted, preserve occurrence identity or update the audit map. Two rows with the same ID must remain separately traceable when both are included.

Avoid using a distinct-ID count to justify a subtotal. Counting fifteen unique IDs in sixteen rows does not tell you which numeric amount to remove, whether the repeated values are equal, or whether either record is valid. Conditional sums aggregate contributions, not identities. The relevant check is that the sum formula includes exactly the supplied row occurrences specified by the policy and that the membership ledger reflects that multiplicity.

A useful review question is 'What would change if this policy changed?' Answer it explicitly rather than changing the policy yourself. Here, excluding one M01 would affect every summary that includes that row, but not IT Form or HR Guide. This local impact map helps a future reviewer assess a permitted correction. Until such a correction is authorized, the published training result remains the raw-row subtotal with a duplicate note.

E07-X1 Retain duplicate occurrences under the stated policy — application

Write the duplicate handling note and compute the hypothetical one-occurrence-excluded changes for Ops Guide, Ops total, Guide total, raw total, and IT Form. Keep the original formulas and source untouched.

Submit: A raw-policy statement and a clearly labeled hypothetical impact record.

08 Separate missing amounts, zero amounts, and no matches

Three different situations can produce a numeric subtotal of 0. A query may have no matching rows. It may select a row whose supplied numeric amount is 0. It may select only rows with missing amounts. A fourth possibility is cancellation between positive and negative contributions. The displayed number alone does not identify which situation occurred. A reliable report pairs the subtotal with membership and amount-state evidence when these distinctions matter.

Use assets/zero_states.csv on a separate sheet named ZeroStates. Its columns are Group and Units, with rows 2 through 7: EmptyAmount/missing, MeasuredZero/0, Offset/5, Offset/-5, Known/3, Known/2. The group NoRows does not occur. For each group, a SUMIFS over B2:B7 with the group criterion in A2:A7 returns 0, 0, 0, or 5 as applicable. EmptyAmount is incomplete; MeasuredZero is a supplied zero; Offset is complete net cancellation; NoRows has an empty selected population.

In Materials, Ops Form is not a zero subtotal, but it illustrates the same completeness problem. Its numeric result 7 includes row 3's amount and lacks row 9's contribution. A

statement such as 'Ops Form has 7 net units confirmed from available amounts, with one matching amount missing' preserves the evidence. A statement such as 'Ops Form total is complete at 7' adds a claim the source does not support.

Do not replace missing amounts with 0 merely to make formulas easy to inspect. That edit changes an unknown contribution into an asserted zero and can remove the visible reason for a warning. A genuine zero record should remain numeric 0 and may legitimately contribute no change to a sum. The difference is not arithmetic size but evidence: one value was supplied and the other was not. Preserve that distinction through import, calculation, and handoff.

You may record completeness manually for this small dataset by listing matching rows with missing Units. That is enough for the course's conditional-total objective and avoids hiding a second untested formula behind the report. If you choose to build an additional completeness-count formula, label it separately and test its blank/type semantics in your Excel installation. Do not claim that SUMIFS itself certifies the presence of every amount it sums.

A repaired amount requires evidence, not guesswork. Later in the controlled-change exercise, the course explicitly supplies a test value for the missing cell and asks you to observe the affected totals. That is a reversible training perturbation, not a conclusion that the original missing value was really that number. Restore the empty source cell after the test and restore the incomplete status as well as the numeric subtotal.

A completeness note should identify the unresolved contribution precisely enough to support a later correction. 'Some data missing' is weaker than 'M08 at worksheet row 9 matches Ops Form but has no Units value.' The second statement tells a reviewer which source record needs evidence and which subtotal is affected. It does not claim the missing amount is positive, negative, or zero. If the amount eventually becomes known, the revised total may rise, fall, or stay numerically unchanged. A newly supplied 0 would resolve completeness while leaving the subtotal 7 unchanged. This is another reason to track amount state separately from numerical changes: unchanged arithmetic can accompany a meaningful improvement in evidence.

E08-X1 Separate missing amounts, zero amounts, and no matches — application

Use ZeroStates to classify EmptyAmount, MeasuredZero, Offset, NoRows, and Known. Supply each numeric subtotal, matching worksheet rows, and the strongest justified interpretation. Then state the appropriate qualification for Materials Ops Form.

Submit: Five subtotal-state records and a qualified Ops Form statement.

09 Keep blank categories visible in reconciliation

Blank category fields are not blank amounts. A row can have a known numeric contribution while its department or type is missing. Materials row 14 has a blank Department, Type=Guide, and Units=3. Rows 10 and 15 have blank Type with known amounts 4 and 2. Those numbers belong to the raw total, even though named-category summaries may exclude them. A reconciliation that ignores blank categories can understate the supplied numeric population.

To total blank departments, use =SUMIFS($D$2:$D$17, $B$2:$B$17, ""). To narrow that bucket to Guide, add the type pair $C$2:$C$17, "Guide". Both give 3 in this dataset because the only blank-department row is a Guide. To total blank types, test $C$2:$C$17 against "" and obtain 6. These formulas use intentionally genuine empty cells under the case's input contract.

A visible space is not the same input as a genuinely empty cell. Neither is the text Unknown or the literal marker [blank]. The CSV supplies empty fields, and the import instructions ask you to preserve them. If a learner types a space to make an empty-looking cell, the representation has changed. Inspect the source value and correct the import from the supplied file rather than broadening the criterion until an expected total appears by accident.

Do not carry a category forward from the previous row. Row 10's blank Type does not become Form merely because row 9 is Form. Row 14's blank Department does not become Ops merely because row 13 is Ops. Such fill-down cleaning would move amounts into named categories and change their subtotals. It may be a valid transformation under a different explicit source convention, but this exercise does not authorize it.

A complete department reconciliation uses Ops 53, HR16, IT30, and blank 3. A complete type reconciliation uses Guide 70, Form 16, Poster 10, and blank 6. Each collection sums to the same raw numeric total 102 because each source row belongs to exactly one bucket on that axis. The missing Units row still makes some buckets incomplete even though the arithmetic reconciliation works. Reconciliation proves coverage of available contributions, not knowledge of an omitted amount.

Use reader-friendly labels without confusing them with criteria. A displayed report label can say Unspecified department, while the formula uses an explicit empty-string criterion. Document that mapping so a reviewer does not assume the source contains the words Unspecified department. The report should make missing categorization visible and actionable without inventing a new raw label or moving the record into a department that was never supplied.

E09-X1 Keep blank categories visible in reconciliation — application

Write formulas for blank Department, blank Type, and blank Department with Guide. Reconcile the raw numeric total once by department and once by type. Explain why the row 9 missing amount warning survives both reconciliations.

Submit: Three blank-category formulas and two complete partition reconciliations.

10 Preserve signed adjustments in net totals

The Materials measure is net logged units, so signed adjustments belong in the calculation. M15 at row 16 is an IT Form return of-2 units. M07 at row 8 is an IT Form movement of 6 units. Their net total is 4. A sum restricted to positive amounts would produce 6, which answers a different question: positive logged units before returns. Neither label should be used interchangeably with the other.

A negative amount is not automatically a spreadsheet error. It must be judged against the source contract. Here the contract explicitly permits a supplied return adjustment. Keep its sign and its row membership. Replacing-2 with 2 would turn a return into an addition and make IT Form 8. Deleting the adjustment would make IT Form 6. These outcomes are arithmetically simple but semantically wrong for the requested net measure.

Build two clearly labeled diagnostics if you want to explain the net. Positive IT Form units use =SUMIFS($D$2:$D$17, $B$2:$B$17, "IT", $C$2:$C$17, "Form", $D$2:$D$17, ">0") and give 6. Negative IT Form units use the same pairs with "<0" and give-2. Their sum is 4. The criteria range may be the same as the sum range when the amount itself is part of the inclusion rule.

The positive-plus-negative decomposition also handles zeros. A numeric zero is neither greater than 0 nor less than 0, but omitting it from those two numeric subtotals does not change their sum. Its membership still matters for statements about how many records were present or whether a group exists. Do not infer record counts from the size of a net subtotal. A net of 0 can arise from a genuine zero or offsetting movements.

Missing amounts require care in a sign-based report. If an amount is unknown, its sign is unknown too. A positive-only subtotal cannot establish that all positive activity is represented when a potentially relevant source row lacks an amount. For the controlled IT Form example all amounts are present. For Ops Form, the missing row prevents a complete interpretation even if the available positive subtotal is easy to calculate.

Use exact labels in your result note: net units, positive units, and negative adjustments. Avoid calling the negative subtotal 'returns count' because it is a signed quantity, not a number of return records. Avoid applying ABS to make all outputs positive unless the task explicitly asks for a magnitude. That change would alter the measure and could make a reconciliation appear to fail when the real issue is inconsistent definitions.

E10-X1 Preserve signed adjustments in net totals — application

Calculate IT Form net units, positive units, and negative adjustments with aligned SUMIFS formulas. State the result of incorrectly deleting the -2 row or changing it to +2, and explain why those are not acceptable repairs.

Submit: Three labeled formulas and two policy-violation impact calculations.

11 Express numeric boundaries without changing the population accidentally

A condition can compare the amount itself to a boundary. To total supplied movements whose Units are at least 10, use =SUMIFS($D$2:$D$17, $D$2:$D$17, ">=10"). The matching rows are 2, 5, 12, 13, and 17 with 12, 15, 11, 12, and 10, giving 60. The equality part matters: row 17 lies exactly at 10 and belongs in an at-least query. A greater-than query would exclude that row and return 50.

For a bounded interval, apply two criteria pairs to the same range. Units at least 5 but below 10 use =SUMIFS($D$2:$D$17, $D$2:$D$17, ">=5", $D$2:$D$17, "<10"). Rows 3, 4, 6, 7, and 8 contribute 7+9+8+5+6=35. This is an AND interval: each included amount satisfies both comparisons. It is not the sum of two independent queries that would overlap across much of the dataset.

Put an editable threshold in F8=10 and label E8=Minimum Units. A criterion that reads that input is ">="&F8. The quotation marks contain the operator, and the ampersand joins it to the current cell value. Writing ">=F8" treats F8 as text inside the criterion rather than reading the numeric threshold. This distinction is easy to miss because both versions look similar in the formula bar.

A threshold may also combine with category conditions. Ops movements with Units at least 10 include rows 2, 13, and 17 and total 34. They do not include row 6's 8 units even though it is Ops Guide. The question has changed from a category total to a category-and-amount total. Keep the label precise so a reader does not compare 34 with the full Ops total 53 and assume an unexplained discrepancy.

Test boundary neighbors deliberately. If the threshold changes from 10 to 11, the overall subtotal falls from 60 to 50 because only the 10-unit record leaves. If it changes to 12, the 11-unit record leaves as well, producing 39. A change to 13 leaves only the 15-unit record, producing 15. These stepwise changes follow the supplied values, not a continuous percentage adjustment. Record the membership difference at each threshold rather than predicting a smooth trend.

The current dataset has one missing amount. A threshold based on Units cannot establish whether that unknown amount should meet the threshold. Report the numeric subtotal from known values and retain a data-completeness qualification if the intended question covers all logged movements. Do not infer that the missing row is below the threshold merely because it contributes nothing numerically. Unknown membership under an amount test is a separate limitation from a definite label mismatch.

Numeric bands can form a valid partition of known amounts if their boundaries are disjoint and exhaustive. In Materials, the negative band contributes-2, the band 0<=Units<5 contributes 9, the band 5<=Units<10 contributes 35, and the band Units>=10 contributes 60. Their sum is 102. The zero record belongs to the second band even though it adds nothing. The missing amount is not assigned to a numeric band because its value is unknown. Adjacent bands should not both include the shared endpoint:using<=10 in one

band and>=10 in the next would count the 10-unit row twice. Define the intervals in words and operators before interpreting the reconciliation.

E11-X1 Express numeric boundaries without changing the population accidentally — application

Calculate all known Units>=10, known Units>=5 and<10, and Ops known Units>=10. Build the threshold-cell version and test thresholds 11, 12, and 13 before restoring 10. State the effect of the missing amount on interpretation.

Submit: Three formulas, four threshold results with membership changes, and a completeness qualification.

12 Implement OR without double-counting overlap

SUMIFS applies simultaneous conditions within one expression, so an OR question requires deliberate construction. 'Guide or Poster' is easy in this dataset because Type is a single field with mutually exclusive values. Add the Guide subtotal 70 to the Poster subtotal 10 to obtain 80. No row can have Type equal to both Guide and Poster at once under the supplied representation, so these two sets do not overlap.

'Ops or Guide' is different because it combines two fields. Ops total 53 includes some Guide rows, and Guide total 70 includes some Ops rows. Simply adding them gives 123 and counts the shared Ops Guide contribution 32 twice. Subtract that overlap once: 53+70-32=91. This is inclusion-exclusion for two conditions. The desired population contains each row satisfying either condition once, not each qualifying condition once.

The formula can be written as three ordinary SUMIFS terms: =SUMIFS($D$2:$D$17, $B$2:$B$17, "Ops")+SUMIFS($D$2:$D$17, $C$2:$C$17, "Guide")-SUMIFS($D$2:$D$17, $B$2:$B$17, "Ops", $C$2:$C$17, "Guide"). Inspect each term's population and keep all ranges aligned. A long expression is not automatically correct; the row ledger should show why the overlap is removed exactly once.

A useful manual check is to list excluded rows instead. Ops or Guide excludes HR Form row 7 with 5, IT Form row 8 with 6, HR blank-type row 15 with 2, and IT Form adjustment row 16 with-2. Their net contribution is 11. The raw numeric total 102 minus 11 equals 91. This check reaches the same result from the complement of the selected population and exposes a missed negative adjustment.

The missing Ops Form amount is in the OR population because Department is Ops, regardless of its unknown Units. Therefore the numeric result 91 remains incomplete. Inclusion-exclusion does not solve data missingness. Likewise, retaining the repeated M01 twice is still required by raw-row policy. Set overlap between conditions is not the same issue as repeated source rows; each supplied occurrence can belong to the overlap and must be handled consistently.

Do not use a wildcard to simulate this OR logic. A criterion such as "Ops, Guide" is a literal string, not a list of alternatives. A criterion such as "*Guide*" broadens text matching within one field but does not express Ops in another field. State whether alternatives are mutually

exclusive categories or overlapping predicates before choosing an arithmetic construction. That decision prevents both under-selection and double-counting.

E12-X1 Implement OR without double-counting overlap — application

Calculate Guide-or-Poster and Ops-or-Guide totals. For the second, show both inclusion-exclusion and a complement check, with row positions and signed amounts. State the relevant missing-data warning.

Submit: Two OR formulas, an overlap ledger, and an independent complement reconciliation.

13 Distinguish literal labels from wildcard patterns

A criterion that looks like a product label may contain characters with special matching behavior. In SUMIFS criteria, an asterisk can match a sequence of characters and a question mark can match one character. A tilde can escape a literal wildcard character. These features are useful when the task requests a pattern, but they can broaden a supposedly exact category total if you use them unintentionally.

Import assets/label_patterns.csv at A1 on a sheet named Patterns. It has columns Label, Units and five rows: Guide/4, Guide-A/6, Guide-B/3, Guide*/2, and Form/5 in worksheet rows 2:6. The label Guide* in row 5 contains a literal asterisk. =SUMIFS($B$2:$B$6, $A$2:$A$6, "Guide") selects only row 2 and returns 4. It does not include longer labels merely because they begin with the same word.

The criterion "Guide*" is a pattern and selects rows 2, 3, 4, and 5, returning 15. It includes the literal-star label as well as the plain and suffixed labels because each begins with Guide. To select only the literal label Guide*, use "Guide~*", which returns 2. To select the one-character suffix labels Guide-A and Guide-B, use "Guide-?", returning 9. These are different questions, not alternative spellings of the same exact match.

A selector cell can carry a pattern too. If F2 contains Guide*, using F2 as the criterion applies the wildcard meaning. Referencing a cell does not automatically make its contents literal. If the report promises literal-label selection, the interface and formula design must account for wildcard characters rather than relying on a user to remember their special meaning. For this course, write the escaped criterion explicitly in the literal-star exercise.

Keep pattern matching separate from data cleaning. A broad Guide* criterion may make an unexpected Guide-A row appear in a total, but that does not prove the row should be reclassified as Guide. The requested measure determines whether suffix variants belong. Do not repair an unfamiliar label by broadening the pattern until the desired number appears. Review the source labels and the stated inclusion rule first.

The main Materials categories contain no wildcard characters, so its exact-label formulas remain straightforward. This small separate lab teaches the boundary without changing the main source contract. Your evidence should name the criterion, the selected row positions, and the subtotal. That combination makes it clear whether a result came from literal equality, a prefix pattern, a single-character pattern, or an escaped wildcard.

E13-X1 Distinguish literal labels from wildcard patterns — application

On Patterns, compute subtotals for criteria Guide, Guide*, Guide~*, and Guide-?. List selected worksheet rows for each and explain why putting Guide* in a selector does not force literal matching.

Submit: Four criterion/membership/subtotal records.

14 Reconcile partitions rather than overlapping requests

A reconciliation should account for each source contribution exactly once. Department buckets form a partition when every row has one department category, including an explicit blank bucket. Type buckets form another partition when every row has one type category, including blank. The two partitions can each reconcile to the raw numeric total, but adding both sets of subtotals together would count every contribution twice.

The six familiar requests are Ops Guide 32, Ops Form 7, HR Guide 9, IT Guide 26, all Form 16, and blank Department Guide 3. Their numeric outputs sum to 93. That number is not a valid raw-total reconciliation. The all-Form subtotal overlaps the department-specific Ops Form query, while other source categories are omitted. An accidental resemblance to a useful subtotal, such as the matrix total 93, does not make the six-request sum a partition.

Prove the coverage rule using row positions. Row 3, Ops Form 7, appears in both Ops Form and all Form, so it is counted twice when those outputs are added. Row 17, Ops Poster 10, appears in none of the six requests. Row 10's blank-type 4 and row 15's blank-type 2 are also excluded. A discrepancy may combine double-counting and omissions, so its net size alone does not reveal the underlying mistakes.

The department partition is 53+16+30+3=102. The type partition is 70+16+10+6=102. These are two independent ways to cover the available numeric source values. A further check is to sum the raw Units column directly with =SUM(D2:D17). It also returns 102. Agreement supports range coverage and category assignment, but the missing row 9 amount still prevents a claim that every contribution is known.

Use a reconciliation difference cell only after naming the compared populations. A difference of 0 between two equally incomplete or identically misaligned calculations is weak evidence. The manual category membership and direct raw sum should provide independent routes. If the difference is nonzero, inspect missing buckets, duplicated query coverage, range endpoints, and signed adjustments before altering any source value.

Document what a passed reconciliation establishes. Here it establishes that the partitioned numeric subtotals account for all supplied numeric contributions once under the raw-row policy. It does not establish that duplicates are accidental or legitimate, that missing amounts equal 0, or that the fictional movements correspond to real inventory. A carefully bounded conclusion is more useful than a broad statement that the data has been validated.

An arithmetic difference can hide several competing population errors. In the six-request sum, the available Ops Form contribution 7 is duplicated, but Ops Poster 10 and blank-type

contributions 6 are omitted. The net difference is 7-10-6=-9, which explains why 93 is 9 below the raw 102. Missing row 9 appears in both overlapping Form requests but adds no known numeric amount, so its duplicated membership is invisible in that difference. A numeric reconciliation alone cannot expose every membership problem when some contributions are zero or unknown. Pair the difference explanation with the row ledger and preserve the missing-data warning even after the known-value difference is fully explained.

E14-X1 Reconcile partitions rather than overlapping requests — application

Show why adding the six requested subtotals is not a raw-total reconciliation. Identify one double-counted and two omitted contributions. Then supply valid department and type reconciliations and state exactly what their agreement proves.

Submit: An overlap/omission diagnosis and two valid partition checks.

15 Predict the impact of one controlled source change

A conditional total should respond only when a changed row belongs to its selected population. Test that behavior in a duplicate workbook so the supplied baseline remains unchanged. First change Materials!D6, M05's Ops Guide amount, from 8 to 9. Predict the affected reports before editing: Ops Guide, Ops total, Guide total, raw total, and Ops-or-Guide each increase by 1. IT Form and all Form stay unchanged because the edited row is not Form.

A source-label change tests membership rather than amount arithmetic. Restore D6=8, then change C6 fromGuide toPoster while leaving the amount 8 unchanged. Ops total and raw total remain 53 and 102. Ops Guide falls from 32 to 24, Ops Poster rises from 10 to 18, Guide total falls from 70 to 62, and Poster total rises from 10 to 18. The row moved between type buckets without changing the department or the total available amount.

Now test the missing amount separately. Restore C6=Guide. In a test copy only, put 5 into D9, replacing the deliberate missing value for M08. Ops Form rises from 7 to 12, all Form from 16 to 21, Ops total from 53 to 58, and raw total from 102 to 107. The warning for those affected populations can be removed in that test state because the course supplied a numeric value for the experiment. This is not evidence that the original missing value was 5.

Restore D9 to a genuinely empty cell, not a space and not 0. The numeric totals return to their baseline values, and the completeness warning returns too. Restoration therefore has two parts: the arithmetic state and the evidence state. A learner who restores 7 as the Ops Form subtotal but leaves D9=0 has not restored the original source, even though the numeric result is the same.

Keep the three experiments isolated. If you change an amount and its type together, the observed difference may combine several effects and become harder to diagnose. A good log records source cell, original value or blank state, new value, affected queries, unaffected queries, observed results, and restoration. The purpose is to test the intended dependency, not to create a more convenient dataset for the final submission.

An unchanged output may have several explanations. The row may not belong to that query, the summary may refer to another range, the cell may contain a pasted value, or calculation may not yet have run. Use the membership prediction and formula inspection to distinguish

those possibilities. Do not assume that every unchanged result is correct simply because some queries should remain stable. The test is strongest when it names a result that must change and another that must not.

E15-X1 Predict the impact of one controlled source change — application

Run the amount, category, and missing-amount tests independently in a copy. Record the specified affected and unaffected totals, then restore D6, C6, and D9 exactly. Include completeness-state restoration for D9.

Submit: Three controlled-change logs with both numerical and source-state evidence.

16 Complete an independent materials summary

The independent case concerns a fictional exhibit distribution desk. Import assets/capstone_distribution.csv into a new sheet named Distribution at A1. Its twelve records occupy rows 2:13 with columns RecordID, Region, Type, Units. The measure remains net signed Units across every supplied raw row. The repeated T01 record is intentionally retained, one amount is missing, one is zero, a return adjustment is negative, and some category fields are blank. Do not carry over the Materials row 17 endpoint.

Produce six requested totals: North Leaflet, North Card, South Card, East Leaflet, all Card, and blank Region Leaflet. For each, write an aligned SUMIFS formula and a membership ledger containing worksheet row, ID, amount or missing state, and numeric contribution. Supply a completeness statement beside each result. A zero result must be explained as a no-match case, a measured-zero population, a missing-only population, or a net cancellation as appropriate.

Create a Region-by-Type matrix using North, South, East as row selectors and Leaflet, Card as column selectors. Fill it from one seed with fixed source ranges and appropriately moving selectors. Reconcile the matrix to the raw numeric total by identifying omitted blank-category contributions. Separately reconcile by complete Region buckets and complete Type buckets. Do not add the six requested outputs as if they were mutually exclusive.

Add two OR summaries: Leaflet or Card, and North or Leaflet. Decide whether each pair is disjoint or overlapping before writing formulas. For the overlapping case, identify and subtract the overlap once. State whether a missing contribution belongs to each selected population. A correct numeric result without a matching completeness explanation is not a complete submission.

Run two isolated tests in a duplicate workbook. First change the return adjustment T05 from-3 to-4 and predict exactly which requested totals and reconciliations change. Restore -3. Next supply a temporary test amount 5 for the missing T06 Units cell, record the affected numeric totals and completeness states, and restore the genuine blank. The test amount is given solely for the experiment and must not become a fabricated baseline value.

The student CSV contains source inputs only. Submit a formula-bearing workbook, all requested membership records, the reconciliation logic, and the restored test log. Record the application and version used. The companion deterministic checker verifies expected row membership and arithmetic, not native Excel behavior. If a formula has not been executed in

your installation, say so precisely rather than claiming that an expected number proves the workbook works.

E16-X1 Complete an independent materials summary — application

Complete the six totals, matrix, two partition reconciliations, two OR queries, and two restored tests exactly as described. Preserve both T01 occurrences and all supplied blank states. Include formula text and actual workbook observations.

Submit: An independently constructed report with row-level evidence, qualification, and a restored baseline.

17 Extend the source window and hand over a bounded result

Conditional totals have a source-window boundary as well as criteria boundaries. In a separate copy of Materials named MaterialsExtended, append the supplied record from assets/append_movement.csv at row 18: M17, HR, Poster, 4. The original fixed ranges end at row 17, so they do not include this appended record. If the report is now intended to cover seventeen records, extend every sum and criteria range consistently to row 18. Do not extend only the amount range.

After the extension, the raw numeric total becomes 106, HR total 20, and Poster total 14. Existing Guide and Form totals remain 70 and 16 because the new record is Poster. The named-department/type matrix gains 4 in HR Poster and its sum becomes 97. The same blank-category difference 9 still reconciles 97 to 106. These predictions make a focused regression test for both source-window alignment and category membership.

The original six requested totals remain unchanged because none selects HR Poster. That is not proof that the append was ignored: the raw total, HR total, and Poster total must change. Choose tests that include the appended row and tests that exclude it. A review limited to the six unchanged requests would provide no evidence that the source window was extended correctly. The behavior must be interpreted against the selected populations.

Keep the sixteen-record baseline and seventeen-record variant clearly distinguished. The extension is a training scenario, not a silent amendment of the original source. When handing over a report, state its source file, first and last data rows, raw-row policy, measure unit, and any incomplete selected populations. A short statement such as 'available net units across Materials rows 2:17, including both M01 occurrences; Ops Form amount missing at row 9' is more useful than a generic assurance that the file was checked.

Review the report through three independent lenses. Structure: range starts, ends, columns, and selector references match the source contract. Membership: selected row occurrences agree with the requested conditions, including overlaps and blank categories. Contribution: signed numeric values add correctly, and missing values remain qualified rather than invented. A passing numeric total cannot replace the other two reviews because different errors can cancel or coincidentally produce the same number.

Conclude with a specific release or revise decision. A report is ready for this fictional exercise when its formulas are complete, its membership evidence agrees, its available-value totals reconcile, and all temporary edits are restored. If native Excel recalculation has not been observed, retain that limitation rather than overstating the check. If a source amount remains missing, release only the qualified subtotal requested by the exercise, not an unqualified complete total.

For the extended variant, inspect a formula that changes and one that stays numerically unchanged. HR Poster must now select row 18 and return 4, but IT Guide still returns 26 from rows 5 and 12. Both formulas should nevertheless use the same extended rows 2:18 source window. A formula can accidentally retain rows 2:17 and still give the right IT Guide result because the appended row does not match. Comparing only values would miss that inconsistent window. Inspect the actual endpoint in every formula family. This is a useful distinction between current-result correctness and future-use correctness:the stale IT Guide range may fail when a later appended record belongs toIT Guide.

E17-X1 Extend the source window and hand over a bounded result — application

Create the seventeen-record variant, extend all aligned ranges, and verify the predicted changed and unchanged reports. Then write a concise baseline handoff note naming the source window, policy, missing amount, and actual verification method.

Submit: An extension regression record and an evidence-bounded handoff statement.

Assessment

Choose one best answer per question. Questions 1–10 check the foundation concepts; questions 11–20 apply the extended study units. Complete and submit the practical tasks separately. A strong quiz score does not replace correct practical work.

1. In SUMIFS(sum_range, criteria_range 1, criteria 1, ...), what is the first argument?

A. The first category label

B. The numeric contribution range

C. The first criteria range

D. The output address

2. One SUMIFS tests Department="Ops" and Type="Guide". Which rows contribute?

A. Rows satisfying both conditions at corresponding positions

B. Only the first row for each ID

C. Rows selected after sorting by amount

D. Rows satisfying either condition

3. Why must a Units range and its label ranges correspond row for row?

A. To test each amount against its own record labels

B. To force alphabetical order

C. To make every label identical

D. To remove every empty cell

4. The original foundation includes R01 twice and specifies raw-row totals. What is required?

A. Delete the second occurrence

B. Include both and flag the repeated ID

C. Negate the second occurrence

D. Ignore both occurrences

5. In the original foundation, R08 has missing Units and R10 has numeric 0. Which interpretation is justified?

A. Both certify zero activity

B. R08 is a valid negative adjustment

C. R08 is unknown; R10 supplies a real zero

D. Neither row can satisfy a category condition

6. Which explicit criterion selects genuinely blank Department cells in the controlled source?

A. ""

B. "Blank"

C. ">0"

D. "Guide"

7. Original Ops Guide rows contribute 10, 7, and 10, including both R01 occurrences. What is the raw-row subtotal?

A. 17

B. 37

C. 35

D. 27

8. Why is adding the original six requested outputs not a valid raw-total reconciliation?

A. Every query is a mutually exclusive partition

B. Conditional sums cannot be added mathematically

C. All source amounts are text

D. Some queries overlap and others omit categories

9. A row has a genuinely blank Type. How does it behave under a literal Guide criterion?

A. It inherits Guide from the preceding row

B. It matches every text label

C. It does not match Guide

D. It invalidates every SUMIFS formula

10. Which check most directly audits the intended selected population?

A. Compare number formats

B. List included row positions and independently add their amounts

C. Paste the same formula into a second cell

D. Confirm that the result is positive

11. D2:D17 and B3:B18 each contain 16 cells. What is the main risk if they are paired as sum and department ranges?

A. Amounts are tested against neighboring records rather than their own labels

B. They must be correct because sizes agree

C. SUMIFS automatically realigns them

D. The criterion becomes an OR rule

12. A selected population contains one row with missing Units and no numeric amounts. SUMIFS shows 0. What should the report say?

A. No rows matched

B. The available numeric subtotal is 0, but the selected amount is incomplete

C. The source certifies zero activity

D. Delete the selected row

13. The criterion must read a numeric threshold from F8 and include amounts at least that value. Which construction is correct?

A. ">="&F8

B. F8&">="

C. ">"&F8

D. ">=F8"

14. Ops subtotal 53 and Guide subtotal 70 overlap by 32. What is the Ops-or-Guide numeric subtotal?

A. 32

B. 123

C. 91

D. 21

15. IT Form has a +6 movement and a -2 return under a net-units contract. What is the correct subtotal?

A. 8

B. 6

C. 4

D. 2

16. Patterns contains a literal label Guide*. Which criterion selects that literal label rather than a prefix pattern?

A. "Guide*"

B. "*Guide"

C. "Guide?"

D. "Guide~*"

17. A matrix totals 93 while raw numeric Units total 102. Blank-type contributions are 6 and blank-department Guide contributes 3. Which conclusion is justified?

A. The raw data must be changed to 93

B. The omitted buckets reconcile 93+6+3=102; missing-amount completeness still needs its own note

C. SUMIFS cannot handle blank categories

D. The matrix is a complete population without qualification

18. Changing M05 Type from Guide to Poster leaves its amount 8 and Department Ops unchanged. Which total must remain unchanged?

A. Ops Guide subtotal

B. Guide total

C. Raw numeric total

D. Poster total

19. A temporary 5 is entered in a previously missing amount cell. What restores the baseline faithfully?

A. Replace 5 with 0

B. Leave 5 because it improves completeness

C. Delete the whole source row

D. Restore a genuine blank and the missing-data warning

20. A row 18 HR Poster movement is appended below ranges ending at 17. Which check best proves a complete range extension?

A. Inspect only unchanged Guide queries

B. Extend only the sum range

C. Assume the source-window boundary is irrelevant

D. Extend every paired range and verify raw, HR, and Poster totals change while unrelated queries stay fixed

Foundation completion criteria

Practical pass: all six conditional totals match 27, 5, 8, 21, 15, 2; included rows are explainable; duplicate and blank policies are explicit. Quiz target: 8 of 10.

Sources and further reading

Microsoft Excel: SUMIFS function
https://support.microsoft.com/en-us/excel/functions/sumifs-function

Microsoft Support:SUMIF function
https://support.microsoft.com/en-us/excel/functions/sumif-function

Microsoft Support:How to correct a VALUE error in SUMIF/SUMIFS
https://support.microsoft.com/en-us/excel/how-to-correct-a-value-error-in-the-sumif-sumifs-function