ETX5900 Business Statistics

MONASH UNIVERSITY · POSTGRADUATE COURSEWORK · SEMESTER 2, 2026

Full guide + ask Sia about ETX5900

SIDE 1/2 | EXAM REWARDS · select → set up → compute → decide → interpret | EXAM REVISION SHEET | Final: **50%** · formula sheet + statistical tables provided

0 · Exam Map

COURSE.JSON · BRIEF

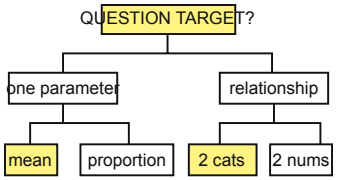
15	15	20	FINAL 50

ASSESSMENT	WT
In-class activities / Exercise (Weeks 2–12, best 9 of 11, group)	15%
Take-home Quizzes / Quiz-Test (Weeks 1–11, best 10 of 11, 1 attempt, 60 min)	15%
Assignment (Written) Part A + Part B on supplied Excel dataset	20%
Final Examination · individual invigilated e-exam	**50%**

Permitted materials: not confirmed for this offering in the course materials we hold — check the exam instructions on the LMS.

1 · Procedure First

CH 12 · TOPIC MAP



Chooser: mean → z/t; proportion → z; two categorical → χ^2; two numeric → regression.

IF ASKED	USE	CRITICAL FORK
Estimate μ	mean CI	σ known: z; unknown: t
Test μ	mean z/t	tail from H_1
Estimate/test π	proportion z	CI uses p; test uses π_0
Association, counts	χ^2	all expected ≥5
Linear relation	slope t	df=n−2

WHAT THE FINAL REWARDS

1. **Translate:** name the population parameter, sample statistic and business claim. Put equality in H_0; let H_1 determine direction.
2. **Select:** mean, proportion, categorical association or numeric relationship; then choose estimation versus testing.
3. **Qualify:** show the condition that licenses the method—σ known/unknown, normal approximation, expected count, correct df or observed prediction range.
4. **Calculate visibly:** write SE before the statistic or margin; carry precision until the final answer; include units.
5. **Decide twice:** statistic versus critical value and, when supplied, p versus α. The inequalities must agree.
6. **Interpret:** name the parameter and groups; state direction only when supported by the sample; use "associated with" for observational regression.

FAST CHECKSUM	MUST BE TRUE
probability / p	between 0 and 1
variance / χ^2 / R^2	non-negative; $R^2 \le 1$
CI	lower < estimate < upper

2 · Data & Description

CH 1–2

VARIABLE	MEANING	PICTURE
Nominal	unordered label	bar / pie / Pareto
Ordinal	ordered labels; gaps unequal	ordered bar
Discrete	countable numerical	histogram
Continuous	measured interval	histogram
Interval	equal gaps, no true zero	°C, calendar year
Ratio	true zero; ratios meaningful	price, count

Population size N → parameters μ, σ, π. **Sample** size n → statistics $\bar{x}$, s, p. Digits do not make an identifier numerical.

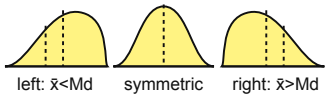
CENTRE & SPREAD

$\bar{x} = \Sigma x_i/n$ · IQR = $Q_3 - Q_1$

$s^2 = \Sigma(x_i-\bar{x})^2/(n-1)$ · $s=\sqrt{s^2}$

CV = (s/$\bar{x}$)×100%

Sample variance divides by n−1; population variance divides by N. Use CV—not raw s—to compare relative spread across different means or units.



Source Ch 2: the mean follows the long tail; the median resists outliers.

CHOOSE THE SUMMARY

Roughly symmetric → mean + s. Skewed/outliers → median + IQR. Empirical rule applies only to bell-shaped data: about 68%, 95%, 99.7% lie within 1, 2, 3 SDs.

BOXPLOT	READ
five-number summary	min, Q_1, median, Q_3, max
shape	off-centre median + unequal whiskers
middle 50%	box width = IQR

WORKED SUMMARY: EIGHT MONTHS

Sales ($000): 12, 14, 15, 15, 18, 21, 23, 30. Σx=148, n=8, so $\bar{x}$=**18.5**. Median=(15+18)/2=**16.5**; mode=**15**. $\Sigma(x-\bar{x})^2$=246, so sample s^2=246/7=**35.14** and s=**5.93** ($000). CV=(5.93/18.5)×100%=**32.0%**. Because $\bar{x}$>median and 30 stretches the high tail, call it right-skewed and use the median as the fairer typical month.

SAMPLING DESIGN	RECOGNITION CUE
simple random	every item has a chance; random selection
systematic	random start, then every kth item
stratified	sample within every defined subgroup
cluster	select whole natural groups
convenience / judgement	easy or researcher-chosen; biased risk

3 · Probability Rules

CH 3

OR · UNION

P(AuB)=P(A)+P(B)-P(AnB)

NOT · COMPLEMENT

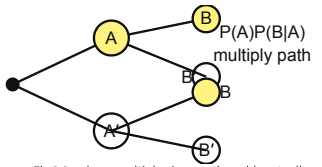
P(A′)=1-P(A) · "at least one" = 1-P(none)

GIVEN · CONDITIONAL

P(A|B)=P(AnB)/P(B), P(B)>0

AND · MULTIPLY

P(AnB)=P(A|B)P(B)



Source Fig 3.2 redraw: multiply along paths; add mutually exclusive leaf paths.

INDEPENDENCE IS A TESTABLE EQUALITY

A and B independent iff **P(A∩B)=P(A)P(B)**, equivalently P(A|B)=P(A). Mutually exclusive means P(A∩B)=0; if both events have positive probability, mutually exclusive events are dependent.

TABLE READ	NUMERATOR	DENOMINATOR
marginal P(A)	A row/column total	grand total
joint P(A∩B)	inner cell	grand total
conditional P(A|B)	A∩B cell	**B total**

MICRO-CHECK: DEPARTMENT × COMPLETION

Of 300 employees: Sales completed 80, not 40 (120); Operations completed 90, not 90 (180). Completed total=170. Thus P(C)=170/300=**.567**; P(S)=120/300=**.400**; P(C|S)=80/120=**.667**; P(S∩C)=80/300=**.267**.

Addition: P(S∪C)=.400+.567−.267=**.700**. Independence would require P(S)P(C)=.400×.567=**.227**; because .267≠.227 (also .667≠.567), department and completion are dependent.

WORDING	OPERATION	GUARDRAIL
A or B	add, subtract overlap	union cannot exceed 1
A and B	multiply conditional path	do not assume independence
at least one	1−P(none)	include every none path
given B	restrict denominator to B	not grand total

Sequential sampling: without replacement changes the second denominator and numerator, so branches are dependent; with replacement restores the original probabilities and independence.

SET RELATIONS THAT PREVENT SLIPS

4 · Normal & Sampling

CH 4

ONE OBSERVATION

Z=(X-μ)/σ · X=μ+zσ

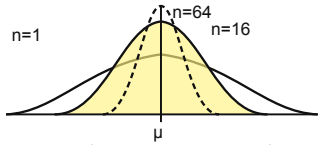
SAMPLE MEAN

Z=(x̄-μ)/(σ/√n) · E(x̄)=μ · SE=σ/√n

SAMPLE PROPORTION

E(p)=π · SE(p)=√[π(1-π)/n]

WANTED AREA	FROM CUMULATIVE Φ
left of z	Φ(z)
right of z	1−Φ(z)
between a,b	Φ(b)−Φ(a)
inverse percentile	find z, then X=μ+zσ



Source Fig 4.2 redraw: every $\bar{x}$ curve centres on μ; larger n shrinks SE.

CLT: for n≥30, $\bar{x}$ is approximately normal regardless of population shape. Single value uses σ; average uses σ/√n.

LANDMARKS

USE	z
90th percentile	1.28
one-tail α=.05	1.645
two-tail 95%	±1.960
two-tail 99%	±2.576

WORKED TAIL: A SAMPLE MEAN

A sampling distribution has μ=85 and SE=2.5. For $\bar{x}$=89, z=(89−85)/2.5=**1.60**. Therefore P($\bar{x}$>89)=1−Φ(1.60)=1−.9452=**.0548**. The denominator is SE, not the original σ, because the random object is an average.

QUESTION OBJECT	CENTRE	SPREAD
individual X	μ	σ
sample mean $\bar{x}$	μ	σ/√n
sample proportion p	π	√[π(1−π)/n]

Inverse normal: area → table z → raw cut X=μ+zσ. A percentile uses one vertical cut, not a two-tailed rejection picture. For small-sample mean inference with σ estimated by s, use Student-t; its heavier tails produce larger critical values, converging to z as df grows.

Empirical-rule shortcut: only for an approximately bell-shaped distribution. Do not use 68–95–99.7 on clearly skewed data, and do not confuse observations within μ±2σ with confidence intervals for μ.

Scale rule: adding a constant shifts centre but not spread; multiplying by a constant multiplies both centre and SD by its magnitude. A z-score is unit-free and preserves order.

WORKED MEAN Z-TEST

5 · Intervals & Tests

CH 5, 7–8

UNIVERSAL CI

estimate ± critical value × standard error

TARGET	INTERVAL / STATISTIC
μ, σ known	$\bar{x} \pm z_{\alpha/2}\sigma/\sqrt{n}$ $Z=(\bar{x}-\mu_0)/(\sigma/\sqrt{n})$
μ, σ unknown	$\bar{x} \pm t_{n-1,\alpha/2}s/\sqrt{n}$ $t=(\bar{x}-\mu_0)/(s/\sqrt{n})$
π interval	$p \pm z_{\alpha/2}\sqrt{[p(1-p)/n]}$
π test	$Z=(p-\pi_0)/\sqrt{[\pi_0(1-\pi_0)/n]}$

Proportion conditions: interval uses np≥5 and n(1−p)≥5; test uses $n\pi_0 \ge 5$ and $n(1-\pi_0) \ge 5$. CI uses p; test uses π_0.



Source Fig 7.1 redraw: H_1 fixes the tail before the table is read.

FIVE SCORED STEPS

1. State H_0 with equality; H_1 carries ≠, > or <.
2. Choose z/t/χ^2/slope t; compute statistic.
3. Read critical value at α, correct tail and df—or compute p.
4. Reject H_0 if p<α or statistic is beyond critical.
5. Conclude in context: sufficient / insufficient evidence.

Errors: Type I rejects true H_0 (probability α). Type II fails to reject false H_0 (β). Power=1−β. At fixed n, lowering α raises β; increasing n can lower both.

CI–test duality: a null value outside a two-sided (1−α) CI is rejected by a two-tailed test at α.

INTERVAL INTERPRETATION & PRECISION

CHANGE	MARGIN E	WHY
confidence ↑	increases	critical value ↑
n ↑	decreases	SE has √n below
σ or s ↑	increases	more sampling spread
E halved	needs ≈4n	inverse square-root

A 95% confidence statement concerns the **procedure over repeated samples**: about 95% of such intervals capture the fixed parameter. Do not assign 95% probability to the fixed μ after this interval has been computed.

TWO-SAMPLE PROPORTION FORK

For H_0:$\pi_1=\pi_2$, form the pooled proportion $\bar{p}=(X_1+X_2)/(n_1+n_2)$ and use it in the test SE. A two-proportion claim "differs" is two-tailed; use the sign of p_1-p_2 only to describe the observed direction after the decision. For two means with unknown σ, use the two-sample t procedure shown on the supplied formula sheet.

DECISION PHRASE	CORRECT CONTINUATION
reject H_0	sufficient evidence for H_1 in context

6 · χ^2, Regression, Forecast

CH 6, 9–11

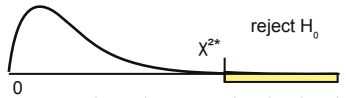
CHI-SQUARE INDEPENDENCE

Use for **two categorical variables** as counts. H_0: independent; H_1: dependent.

f_e=(row total×column total)/n

$\chi^2=\Sigma(f_o-f_e)^2/f_e$ · df=(r-1)(c-1)

Every $f_e \ge 5$; otherwise combine related categories and recompute. $\chi^2 \ge 0$ and is upper-tail only: reject if $\chi^2_{calc} > \chi^2_{crit}$.



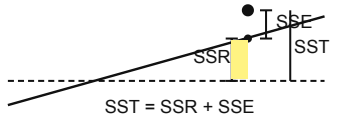
Source Fig 6.1 redraw: evidence against independence lies only in the upper tail.

SIMPLE REGRESSION

$\hat{Y}=b_0+b_1X$ · $b_1=Sxy/Sxx$ · $b_0=\bar{y}-b_1\bar{x}$

$r=Sxy/\sqrt{(SxxSyy)}$ · $e=y-\hat{Y}$

SST=SSR+SSE · R^2=SSR/SST=1-SSE/SST=r^2



Source Fig 9.3 redraw: total deviation = explained + residual.

Slope test: H_0:$\beta_1=0$; t=$b_1/se(b_1)$, df=n−2, two-tailed unless directed. $se(b_1)=\sqrt{(MSE/Sxx)}$; MSE=SSE/(n−2). Interpret b_1 in units; association is not causation; predict inside X-range.

TIME SERIES

linear $\hat{Y}_t=b_0+b_1t$ · quadratic adds b_2t^2

MAD=$\Sigma|Y_t-F_t|/n$ · MSFE=$\Sigma(Y_t-F_t)^2/n$

PATTERN	MOVE
constant change	linear trend
curvature	quadratic trend
seasonal Y=T×S×C×I	deseasonalise Y/S
compare models	lower MAD/MSFE

REGRESSION ANSWER SENTENCE

State $\hat{Y}=b_0+b_1X$, then: "A one-unit increase in X is **associated with** an estimated b_1-unit change in Y."

Explain R^2 as the percentage of Y variation explained by the line. The intercept is meaningful only if X=0 is inside or near the observed range. A residual e>0 means the point lies above the line; e<0 means below.

REGRESSION CHECK	WHAT IT ANSWERS
scatterplot	linearity, direction, outliers
r	strength + direction of linear association
R^2	explained share, not significance
slope t / p	whether β_1 differs from 0
prediction	$\hat{Y}$ at X; flag extrapolation

ETX5900 Business Statistics

MONASH UNIVERSITY · SELF-TEST DRILLS · ANSWER PATH + CLASSIC TRAPS

Full guide + ask Sia about ETX5900

SIDE 2/2 · SELF-TEST · cover the answer path → solve → expose → correct the trap · 5 WORKED DRILLS · Use exact setup, units, decision and context sentence

7 · Drill: Mean t-Test

COURSE WORKED EXAMPLE

Prompt. n=20 jars, $\bar{x}$=48 g, s=6 g; test at 5% whether μ differs from 45 g. σ unknown.

STEP	WORKING
1 · hypotheses	H_0:μ=45; H_1:μ≠45; two-tailed
2 · choose	σ unknown → t, df=19
3 · standardise	SE=6/√20=1.342 t=(48−45)/1.342=**2.236**
4 · cut	α/2=.025; critical ±2.093
5 · decide	|2.236|>2.093; p≈.037<.05 → reject H_0



Answer picture: the statistic crosses the positive two-tail cut.

Conclusion. Sufficient evidence at 5% that mean fill differs from 45 g; sample points to over-filling.

TRAP → *"Differs" means two-tailed; σ unknown means t. Never say H₀ is proven or accepted.*

MARK-BY-MARK SELF-AUDIT

MARK	EVIDENCE ON PAGE
hypotheses	parameter μ, equality in H_0, ≠ in H_1
method	t because σ unknown; df=n−1=19
working	SE first, then signed statistic
tail/table	α/2=.025 in each tail
decision	|t| versus critical and p versus α
context	mean fill, grams, "differs"; direction from $\bar{x}$

Boundary discipline: the conclusion follows H_1, not the sign alone. The negative/positive sign locates the sample relative to μ_0; it does not change a pre-specified two-tailed test into a one-tailed test after seeing data.

LAST-LINE TEMPLATES

DECISION	SENTENCE STEM
reject	At α=…, there is sufficient evidence that [H_1 in context].
fail to reject	At α=…, there is insufficient evidence that [H_1 in context].
CI	We are C% confident the true [parameter] lies from [L] to [U] [units].
slope	Each +1 X is associated with estimated b_1 change in Y.
R^2	The line explains 100R^2% of variation in Y.

Administrative check: duration is listed as "To be advised". Confirm the exact date, duration, platform, conditions and supplied resources on the LMS and personal timetable before the assessment period.

8 · Judgement: Tail & Error

CH 7

IF YOU SEE	DO
differs / not equal	two-tail; split α
exceeds / more	upper one-tail
less / below	lower one-tail

9 · Drill: 95% Mean CI

CH 5 WORKED

Prompt. n=25 bottles, $\bar{x}$=68 mL, s=10 mL; σ unknown. Build a 95% CI and judge target μ=75.

```
t interval; df=24; t.025=2.064
SE=10/√25=2
E=2.064×2=4.128≈4.13
CI=68±4.13=(63.87,72.13) mL
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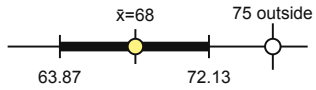


CI–test duality: 75 is outside the 95% interval, so reject μ=75 at 5%.

Interpret. We are 95% confident μ lies between 63.87 and 72.13 mL. Evidence points below 75 mL.

CHANGE	CI EFFECT
higher confidence	wider: critical ↑
larger n	narrower: SE ↓ as √n
larger s or σ	wider
halve margin E	roughly quadruple n

TRAP → *Say 95% describes the long-run interval procedure, not a 95% probability that fixed μ is in this realised interval.*

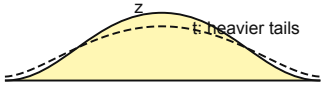
RUN THE INTERVAL ROUTINE ALOUD

1. Parameter is a mean; only s is supplied → t, not z.
2. Confidence 95% → α=.05, split .025 each tail; df=24.
3. Compute SE before margin; retain precision.
4. Put units on both limits and name μ in the sentence.
5. Benchmark outside → reject matching two-tailed H_0 at 5%.

WRONG MOVE	WHY IT FAILS
use z=1.96	σ was not given; s estimates it
divide 10 by 25	SE uses √n
round SE early	can move a borderline limit
say target "impossible"	test supports rejection at α, not certainty

10 · z vs t at Sight

CH 4–5



Source Fig 5.1 redraw: estimating σ costs wider t tails.

Recall: t is indexed by df. Small df means heavier tails and a larger critical value; as df→∞, t approaches the standard normal. This same fork governs both mean intervals and one-sample mean tests.

CONFIDENCE AND TESTING BRIDGE

11 · Drill: χ² Independence

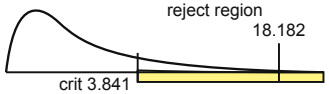
CH 6 WORKED

Prompt. Department × remote preference, n=200: Sales 60 Yes/40 No; Operations 30 Yes/70 No. α=.05.

OBSERVED F_o	YES	NO	TOTAL
Sales	60	40	100
Operations	30	70	100
Total	90	110	200

EXPECTED F_e	YES	NO
Sales	100×90/200=**45**	100×110/200=**55**
Operations	**45**	**55**

$$\chi^2=225/45+225/55+225/45+225/55$$
$$=5.000+4.091+5.000+4.091=\mathbf{18.182}$$



df=(2−1)(2−1)=1; 18.182>3.841, so reject independence.

Conclusion. Sufficient evidence at 5% that department and remote-work preference are dependent.

TRAPS → *Use counts, not percentages; check expected–not observed–counts; df comes from table shape; never halve α.*

CONTRIBUTION LOGIC

Each cell adds $(f_o-f_e)^2/f_e$. The square makes all contributions non-negative; a larger observed–expected gap raises χ^2, while dividing by f_e scales the gap relative to its expected size. Here all four gaps are ±15; the cells with expected 45 contribute 5.000 each, while expected 55 contributes 4.091 each.

CHECK	RESULT HERE
data form	counts in a 2×2 table
minimum expected	45 ≥ 5: valid approximation
degrees of freedom	(2−1)(2−1)=1
tail	upper only because $\chi^2\geq 0$
possible error after rejection	Type I: declare a relation when independent

12 · χ² Fast Checks

CH 6 FAQ

IF YOU SEE	DO
two categorical variables	contingency table + χ^2
any f_e<5	combine adjacent/related categories; recalculate
χ^2 very small	observed close to independence
reject H_0	say variables are dependent/related in context

Do not overclaim: rejection is evidence of association, not causation; failure to reject is not proof of independence.

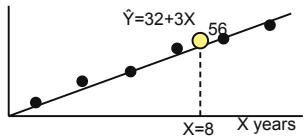
TABLE MECHANICS UNDER PRESSURE

13 · Drill: Regression Chain

CH 10 WORKED

Data. n=6 reps: X=1,3,5,7,9,11 years; Y=34,42,46,55,59,64 ($000). $\bar{x}$=6; $\bar{y}$=50.

PIECE	CALCULATION
sums	Sxy=210; Sxx=70
line	b_1=210/70=3; b_0=50−3×6=32 **Ŷ=32+3X**
predict X=8	Ŷ=32+24=**56** ($000), interpolation
variation	SST=638; SSR=3×210=630; SSE=8
fit	R^2=630/638=**.987**; r=+.994



Worked data: fitted line, six observed points and the in-range X=8 prediction.

Slope test. MSE=8/(6−2)=2; se(b_1)=√(2/70)=.1690; t=3/.1690=**17.75**, df=4. Critical ±2.776; p<.001 → reject H_0:β_1=0. Significant positive linear relationship.

Slope CI: 3±2.776(.1690)=(2.531,3.469), excludes 0 and agrees with the test.

TRAPS → *df=n−2; interpret "each extra year is associated with ≈$3,000"; neither high R^2 nor significance proves causation.*

ARITHMETIC CROSS-CHECKS

IDENTITY	HERE
line through centroid	32+3(6)=50=$\bar{y}$
SST=SSR+SSE	638=630+8
R^2=1−SSE/SST	1−8/638=.987
$R^2=r^2$	.994²≈.987
slope CI/test	0 excluded ↔ reject β_1=0

The observed range is X=1…11, so X=8 is interpolation. A numerically valid substitution beyond that range is still an extrapolation and may be substantively unsafe. The line minimises Σe^2; it does not minimise $\Sigma|e|$.

14 · Output Decoder

CH 9–10

OUTPUT	ANSWER
Coefficients	b_0 intercept; b_1 slope
R Square	share of Y variation explained
slope p-value	linear relationship decision
residual	e=y−Ŷ; sign shows above/below line

Correlation versus regression: r is symmetric in X and Y and unit-free; the prediction line is directional, predicting response Y from explanatory X. r=0 rules out a linear relation, not every possible curved pattern. Plot first and inspect outliers.

MEANING BEFORE MAGNITUDE

15 · Drill: Linear Forecast

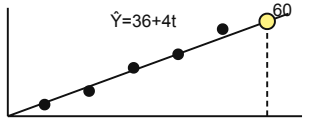
CH 11 WORKED

Data. Weekly takings ($00), t=1…5: 40.5, 43.5, 48, 51.5, 56.5. $\bar{t}$=3; $\bar{Y}$=48.

```
Σ(t-t)(Y-Ȳ)=40 · Σ(t-t)²=10
b1=4 · b0=48-4×3=36
Ŷt=36+4t · Ŷ6=60 ($00)=$6,000
```

T	Y	Ŷ	E=Y−Ŷ	|E|
1	40.5	40	+.5	.5
2	43.5	44	−.5	.5
3	48	48	0	0
4	51.5	52	−.5	.5
5	56.5	56	+.5	.5

MAD=Σ|e|/5=2/5=**.40** ($00). MSFE=$\Sigma e^2$/5=1/5=**.20** squared units.



Worked series: steady rise → linear trend; substitute t=6 for the forecast.

TRAP → *t starts at 1, so b_0 is the fitted level one period before the first observation. MAD and MSFE have different units; never compare one directly with the other.*

FORECAST AUDIT

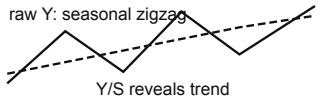
CHECK	WORKED RESULT
mean point	at $\bar{t}$=3, fitted $\bar{Y}$=48=$\bar{Y}$
signed errors	+.5, −.5, 0, −.5, +.5
Σe	0, as expected with an intercept
Σ|e|	2.0 → MAD=.40
Σe^2	1.0 → MSFE=.20

Interpret b_1=4 in the data's units: takings rise by about 4 hundreds of dollars, or **$400 per week**. The forecast 60 is also in $00, hence $6,000. Always convert only after calculating in the equation's units.

16 · Trend & Season Cards

CH 11

IF YOU SEE	DO
roughly constant rise/fall	linear $\hat{Y}_t=b_0+b_1t$
acceleration/deceleration	quadratic; add b_2t^2
S=1.10	period 10% above average
S=.85	period 15% below average
remove season	Y/S
restore season	trend forecast × S



Source Fig 11.2 redraw: divide by seasonal index to expose the underlying trend.

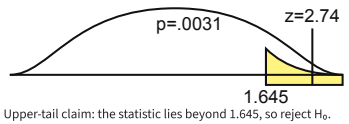
MODEL-CHOICE CARD

17 · Drill: Proportion z

CH 8 WORKED

Prompt. 126 of n=180 graduates employed within three months. Test at 5% whether π>.60; Φ(2.74)=.9969.

STEP	ANSWER PATH
H	H_0:π=.60; H_1:π>.60; upper tail
sample	p=126/180=.70
validity	nπ₀=108; n(1−π₀)=72; both ≥5
SE	√[.60(.40)/180]=.036515
z	(.70−.60)/.036515=**2.74**
p	1−.9969=**.0031**
decision	2.74>1.645; .0031<.05 → reject H_0



Upper-tail claim: the statistic lies beyond 1.645, so reject H_0.

Conclusion. Sufficient evidence at 5% that more than 60% find a job within three months.

TRAP → *A proportion test builds SE from π₀. Using p gives the interval SE and a different z.*

WHY Π₀ BELONGS BELOW

The test asks how unusual p=.70 would be **if H_0:π=.60 were true**, so the null distribution has SE √[.60(.40)/180]. A confidence interval assumes no null value and therefore estimates its SE from observed p. Fix the target and direction before looking at the difference.

QUANTITY	VALUE	MEANING
observed gap	.70−.60=.10	10 percentage points above null
null SE	.036515	sampling spread if H_0 true
z	2.74	gap is 2.74 null SEs
upper p	.0031	tail beyond observed z under H_0

18 · Exam-Morning Loop

CH 12 STRATEGY

1. Read the verb: estimate, test, compare, predict.
2. Name the target: μ, π, categorical association, linear relation, forecast.
3. Write H_0/H_1 and tail before numbers.
4. Circle given σ versus s; record df.
5. Copy formula, substitute, keep 4–5 significant figures.
6. Read the correct table column: α or α/2; correct df.
7. Write the inequality and explicit reject / fail-to-reject line.
8. Finish in business context with direction and units.
9. Check probability ∈[0,1], expected counts ≥5, prediction range.
10. Use mark-proportional pacing; reserve time for decisions and units.

CLASSIC LOST MARK	REPAIR
"accept H_0"	fail to reject H_0

SIXTY-SECOND METHOD RECITAL