Eastern Goldfields College
Mathematics Applications 2016
Investigation 3 (U2 / I1) – Making It Fair

Class time allocated: ~~50~~ 52 minutes

Name : MARKING KEY.

Marks _____ / ~~50~~ 51

MAKING IT FAIR

Introduction

Two classes of 25 Year 8 students have sat the same test in Science. Class 8.1 did the test in period 1 and had 50 minutes, the recommended time. Class 8.2 started the test in period 2 and after 40 minutes the school had to be evacuated and they missed out on the last 10 minutes. The maximum number of marks any student could have achieved in the test was 50. The teachers wanted to adjust the marks so that it was fair to both classes. They marked the test, placed some statistics in the table below and then discussed various options for adjusting the marks.

Science marks for Classes 8.1 and 8.2 (out of 50)

Statistic	Class 8.1	Class 8.2
Minimum	20	15
Maximum	48	41
Median	34	25
Mean	33.76	25.16
First quartile	29	20
Third quartile	38	27
Range	28 ½	26 ½
Inter-quartile range	9 ½	7 ½

Question 1 (6 marks: 2, 2, 1, 1)

(a) Complete the table. ½ ∃ R/U

(b) On the basis of these statistics only, which class has produced a higher standard? Justify your answer.

OR – must state $\bar{x}$ scores OR difference

Class 8.1 ✓

∵ $\bar{x}$ is 33.76 − 25.16 = 8.6 higher than 8.2 ✓

(c) Suggest a reason why the marks might need to be adjusted so that it is fairer for Class 8.2.

∴ would have scored more marks within those 10 min.

must have marks related to time

(c) to be fair = X
not same time = X

(d) Suggest a reason why the marks should **not** be adjusted.

Can be unfair due to:

- a student in 8.2 may not have completed all Q's missed in those 10 min anyway. / may not have achieved that higher mark.

or - a st in 8.2 may have already completed the test.

(d) Unfair = X
do it later = X

Question 2 (4 marks: 1, 2, 1)

(a) The first option considered was to take 10 marks off each person in Class 8.1. Give one reason why this process would be unfair.

- 10 marks is not proportional to how many marks they would/did achieve in those 10 min.

or - Not all st's can get 1 mark ∃ minute.

or - St who passed may now fail

not their fault = X

The teachers decided they would only adjust the marks for Class 8.2. A sample of five students was chosen and the effects of the changes on their marks were examined for each adjustment suggested. The five students chosen and their marks in the test were;

Tom 41 Don 15 Sam 25 Ria 20 Fay 27

(b) Suggest two reasons why this is a good sample.

- they chose students 1 ∃ 5 number summary max, min, median Q, Q marks.

or = 1 mark. (OR Good variation or spread)

Same meaning so, not 2 marks.

- sufficient number of students.

pcy "range" but write "be careful" better word

(c) The second option chosen was to say that the test for Class 8.2 was only out of 40 (instead of 50) so the marks were altered and Ria's 20 out of 50 became 20 out of 40. Would Ria be pleased with this outcome? Explain.

$\frac{20}{50} = 40\%$

$\frac{20}{40} = 50\%$

Ria would be or Yes pleased.

∴ mark for test would increase by 10% / OR increase from 40% to 50%

or fail → pass

if No, then X X 0/2

Question 3 (7 marks: 1, 1, 3, 2)

The third option for adjusting the marks of students in Class 8.2 was to add 10 marks to each student's mark.

reference rate mark/min.

(a) Why was the addition of 10 marks thought to be a fair adjustment?

1 mark = 1 minute ; 10 marks = 10 min lost ✓

(b) What marks do the sample students now get?

Tom 51

Don 25

Sam 35

Ria 30.

Fay 37

✓ R/W. any wrong = ✗

(c) For the adjusted marks in Class 8.2, state the

(i) range 51 − 25 = 26 ✓

(ii) interquartile range 37 − 30 = 7 ✓

(iii) mean 35.16 ✓ Do not accept 35.6

(d) Give two reasons why it is not appropriate to add 10 marks to each student's score.

① Tom receives >100%. ✓

② No student fails. ✓

③ St may not have answered 10 mark awarded. 100% correctly

✓f unfair ✗ mention average ✗ study ✗

Question 4 (7 marks: 3, 2, 2)

③ some st's may have completed test in 40 min + earned more marks than achieved.

It is suggested that *as the students missed a fifth of the time for the test, then add a fifth of their marks onto the total of their original score.*

(a) Show the effect of this adjustment on the sample students by completing the table below.

Student	Tom	Don	Sam	Ria	Fay
Original mark	41	15	25	20	27
One fifth of original mark	8.2	3	5	4	5.4
Adjusted mark	49.2	18	30	24	32.4
Round to the nearest whole number	49	18	30	24	32

✓ R/W ✓ from F1 ✓

all correct in row = ✓ any wrong in row = ✗

(b) For the adjusted marks of the students in Class 8.2, what is the new

(i) range 49 − 18 = 31 or 31.2 ✓

(ii) interquartile range 32 − 24 = 8 or 8.4 ✓

F.T.

(c) Give two reasons why this method of adding a fifth of the students' marks to their original marks is better than adding 10 marks.

✓ • more proportional to student performance / or takes into account student performance.

• 1/5 of time lost / or proportional to time.

Question 5 (11 marks: 3, 1, 1, 1, 1, 2, 2)

The fifth adjustment investigated was to *multiply the marks for students in Class 8.2 by 1.25.*

(a) Show the effect of this process on the sample students by completing the table below.

Student	Tom	Don	Sam	Ria	Fay
Original mark	41	15	25	20	27
Multiply by 1.25 to get new score	51.25	18.75	31.25	25	33.75
Gain in marks	10.25	3.75	6.25	5	6.75
Round new score to nearest whole number	51	19	31	25	34

1 mark / row, all correct in row = 1 mark, any X wrong

(b) What is the range for the new scores of the students in Class 8.2?

51 − 19 = 32

OR 51.25 − 18.75 = 32.5 } ✓ either

(c) Does multiplying by 1.25 give the same results as adding on one-fifth of the original marks? Justify your answer.

No ✓

1/5 = 20% increase. ✓

whereas 1.25 = 25% increase.

×1.25 is a larger increase in result.

(d) List the students in ascending order of their original marks

Don Ria Sam Fay Tom

(e) List the students in ascending order of their gain in marks

Don Ria Sam Fay Tom

(f) Compare the lists produced in parts (d) and (e). Explain the comparison.

There is no change ✓ Order is same
↑ inc in marks proportional original. ✓ must have both } ½ = 1 mark. or X.

(g) Which is a fairer adjustment of the marks?

Determining a fifth and adding it on **OR** Multiplying by 1.25
Justify your decision

If $\frac{1}{5}$ then XX 2/2

✓ x by 1.25

✓ or $40 \times 1.25 = 50$ marks = total for test
$40 \times 1.2 = 48$ marks ≠ total for test.

Question 6 (11 marks: 1, 1, 3, 3, 2, 1)

The last process considered to adjust the marks was to *make both class averages the same (i.e., 33.76)* as the means for both classes were equal in the previous test.

(a) Determine the total of the marks for students in Class 8.2 if the mean of their marks is to be 33.76.

$33.76 = \frac{\Sigma x_{8.2}}{25}$ Total Mark 8.2 = 844 ✓

(b) Determine the total of the marks for students in Class 8.2 before any adjustments.

$25.16 = \frac{\Sigma x_{8.2}}{25}$: Total Marks BEFORE = 629 ✓

(c) To increase the mean for Class 8.2 to 33.76, 8.6 marks can to be added to each student's mark. Describe two ways by which this value (8.6) could have been determined from the data available in this investigation?

(1) $844 - 629 = \frac{215}{25} = 8.6$

✓✓ - 2 correct w working
✓✓ - 1 " " "

(2) $33.76 - 25.16 = 8.6$
$\bar{x}_{8.1}$ $\bar{x}_{8.2}$

(d) Complete the following table using this method of adding 8.6 to adjust the score.

Student	Tom	Don
Original mark	41	15
Marks added	8.6	8.6
Percentage increase	21% (int)	57% or 57.3% (1dp)

✓ each row ✓ ✓

20.9756 or 57.3̇

(e) For the adjusted class data calculate the

(i) median $25 + 8.6 = 33.6$ ✓

(ii) inter-quartile range 7 ✓

(f) Is this process fair to the students in Class 8.2? Explain.

No ✓ If Yes xx 0/2

✓ Don (smallest mark) + 8.6 = % this % is higher than Toms (largest mark)

OR Don/smallest receives same increase in marks as Tom/highest.

Question 7 (4 marks: 2, 2)

(a) For all options chosen complete the table provided expressing numbers to the nearest tenth where numbers are not whole numbers.

Process / Student	Original marks	Add 10 to original marks (Q3)	Add a fifth of the original marks (Q4)	Multiply original marks by 1.25 (Q5)	Add 8.6 to original marks (Q6)
Tom	41	51	49 .2 ok	51 .25 ok	49.6 50 ok
Don	15	25	18	19 18.75	23.6 24
Sam	25	35	30	31 31.25	33.6 34
Ria	20	30	24	25	28.6 29
Fay	27	37	32 .4	34 33.75	35.6 36

F.T.

✓✓ all correct

✓ 1 or 2 errors.

X > 2 errors

(b) Determine the best and worst options as far as these students are concerned.

R/W ✓ Best = +10 ✓ students.

R/W ✓ Worst = $+\frac{1}{5}$

End of Questions