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3

91585M

915855

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

Tohua tēnei pouaka mēnā KĀORE koe i tuhi kōrero ki tēnei pukapuka

Te Pāngarau me te Tauanga (Tauanga), Kaupae 3, 2022

91585M Te whakahāngai ariā tūponotanga i te wā e whakaoti rapanga ana

Ngā whiwhinga: E whā

Paetae	Kaiaka	Kairangi
Te whakahāngai ariā tūponotanga i te wā e whakaoti rapanga ana.	Te whakahāngai ariā tūponotanga, mā roto i te whakaaro pānga, i te wā e whakaoti rapanga ana.	Te whakahāngai ariā tūponotanga, mā roto i te whakaaro waitara e whānui ana, i te wā e whakaoti rapanga ana.

Tirohia kia kitea ai e rite ana te Tau Ākonga ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

Me whakamātau koe i ngā tūmahi KATOA kei roto i tēnei pukapuka.

Tuhia ō whiriwhiringa KATOA.

Tirohia kia kitea ai kei a koe te pukapuka Tikanga Tātai me ngā Tūtohi L3–STATMF

Ki te hiahia wāhi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka.

Tirohia kia kitea ai e tika ana te raupapatanga o ngā whārangi 2–23 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

Kaua e tuhi i ngā wāhi e kitea ai te kauruku whakahāngai ( ). Ka poroa pea taua wāhanga ka mākahia ana te pukapuka.

HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

TE TŪMAHI TUATAHI

I tētahi o ngā kura tuarua o Te Waipounamu, e rua ngā kōwhiringa wāhanga ako i whiria e ngā ākonga Tau 10. E whai ake nei ngā kōwhiringa wāhanga ako a ngā ākonga 167 kei te Tau 10:

- e 62 i kōwhiri ki te mahi i tētahi wāhanga ako hangarau.
- 138 kāore i kōwhiri ki te ako i roto i tētahi wāhanga ako reo.
- 10 i kōwhiri i tētahi wāhanga ako hangarau me tētahi wāhanga ako reo.

(a) Ko te aha te pānga riterite o ngā ākonga i tēnei kura tuarua i Te Waipounamu kāore nei i kōwhiri i tētahi wāhanga ako hangarau, engari e ako ana i tētahi reo?

(b) I kōwhiri matapōkeretia ngā ākonga e toru i roto i te rōpū o te 167 o ngā Tau 10.

Mēnā e ako ana te tokotoru i tētahi wāhanga ako hangarau, whiria te tūponotanga KĀORE he mea kotahi o te tokotoru e ako ana i tētahi reo.

(c) E mea ana te kura, mēnā ka kōwhiri tētahi ākonga i tētahi wāhanga ako hangarau, kāore he pānga o tērā ki te tūponotanga ka kōwhiri hoki ia i tētahi wāhanga ako reo.

Tūhuraina te houtupu o tēnei kōrero.

Whakamahia ngā whakaaro tauanga hei tautoko i tō tuhinga.

QUESTION ONE

At a South Island high school, two option subjects were chosen by Year 10 students. The option subject choices of 167 Year 10 students were as follows:

- 62 had chosen to do a technology subject.
- 138 had not chosen to study a language subject.
- 10 had chosen a technology subject and a language.

(a) What proportion of students at this South Island high school had not chosen a technology subject, but were studying a language?

(b) Three individual students were chosen at random from the group of 167 Year 10 students.

Given all three were studying a technology subject, find the probability that all three were NOT studying a language.

(c) The school claims that if a student selects a technology subject, this has no effect on the probability of them also selecting a language subject.

Investigate the validity of this claim.

Use statistical reasoning to support your answer.

(d) E tautoko ana te kura i ngā ākonga mātāmua (ngā Tau 11 ki te 13) hei whakatītina i a rātou ki te whai i te ara umanga e pīrangitia ana e rātou i muri i te kura tuarua. Puta noa i te kura tuarua, e 475 katoa ngā ākonga kei te kura mātāmua. I whakahaerehia tētahi patapatai i te tīmatanga o te tau kura i te tau 2022, ā, i tonoa ngā ākonga mātāmua me ō rātou mātua kia tautohu i te ara umanga e pīrangitia ana e rātou i muri i te kura tuarua.

Ko te 71.6% te tapeke o ngā ākonga e takune ana ki te haere ki te kura tuatoru, ko te 63.4% e takune ana ki te haere ki te kura tuatoru, ka mutu, e whāia ana hoki te ara umanga e pīrangitia ana, ā, ko te 25.3% o ngā ākonga kāore e takune ana ki te haere ki te kura tuatoru, engari e whai ana rātou i te ara umanga e pīrangitia ana (pērā i te tīmata i tētahi tūranga ihupuku).

(i) Tātaia te tokomaha o ngā ākonga mātāmua kāore e takune ana ki te haere ki te kura tuatoru, ka mutu, kāore e takune ana ki te whai i te ara umanga e pīrangitia ana i muri tata tonu i te kura tuarua.

(ii) Kīia ai, e huarua ana te tūponotanga o te whai a ngā ākonga i te ara umanga e pīrangi ana rātou mēnā e takune ana rātou ki te haere ki te kura tuatoru, tēnā i te tūponotanga o te whai a te hunga kāore e haere ana ki te kura tuatoru.

Tuhia he kōrero mō te tautoko rānei a ēnei raraunga i tēnei kōrero.

Whakamahia ngā tātaihanga me ngā whakaaro tauanga hei tautoko i tō tuhinga.

(d) The school is supporting their senior students (Years 11 to 13) to encourage them to pursue their preferred career pathway after high school. In total, the high school has 475 students in the senior school. A survey was conducted at the start of the academic year in 2022, with every senior student and their parents asked to identify the preferred pathway after high school.

In total, 71.6% of the students were intending on going to university, 63.4% of the total students were intending on going to university and were following their preferred career pathway, and 25.3% of the students were not intending on going to university, but were intending on following their preferred career pathway (e.g. starting an apprenticeship).

(i) Calculate the number of senior students who were not intending on going to university, and were not intending on following their preferred career pathway immediately after high school.

(ii) It is claimed that it is twice as likely for students to be following their preferred career pathway if they intended on going to university, compared to not going to university.

Comment on whether this data supports this claim.

Use calculations and statistical reasoning to support your answer.

(e) Puta noa i te motu o Aotearoa i te tau 2022, e 9985 ngā ākonga e akoako ana i te Kaupae 3 i te Tauanga mō te Urunga ki te Whare Wānanga. E toru ngā whakamātautau e wātea ana kia whāia ka akoako ana i te Kaupae 3 mō te Tauanga (ko te 91584, ko te 91585, ko te 91586 hoki).

I roto i ngā tau maha, kua puta mai ngā pārongo e whai ake nei mō ngā ākonga e uru atu ana ki ngā whakamātautau i te Kaupae 3 mō te Tauanga

- 12% o ngā ākonga kua whakaurua ki ngā whakamātautau e toru.
- E 9% o ngā ākonga kua whakaurua ki te 91584 anake.
- 14% o ngā ākonga kua whakaurua ki te 91585 anake.
- 10% o ngā ākonga kua whakaurua ki te 91586 anake.
- E 57% o ngā ākonga kua whakaurua ki te 91585 me te 91586.
- 17% o ngā ākonga kua whakaurua ki te 91584 me te 91585.
- 17% o ngā ākonga kua whakaurua ki te 91584 me te 91586.

Mēnā kua whakaurua tētahi ākonga ki te 91586, tātaihia te tokomaha o ngā ākonga i te tau 2022 kua whakaurua hoki ki te 91584.

(e) Nationally in New Zealand in 2022 there are 9985 students studying Level 3 Statistics for University Entrance. There are three possible examinations to take when studying Level 3 Statistics (91584, 91585, and 91586).

Over many years the following information is known about students entering Level 3 Statistics examinations

- 12% of students are entered in all three examinations.
- 9% of students are entered only for 91584.
- 14% students are entered only for 91585.
- 10% of students are entered only for 91586.
- 57% of students are entered for 91585 and 91586.
- 17% of students are entered for 91584 and 91585.
- 17% of students are entered for 91584 and 91586.

Given a student was entered for 91586, calculate the number of students in 2022 that were also entered for 91584.

TE TŪMAHI TUARUA

(a) Ko Waipapa Taumata Rau te kura tuatoru nui katoa o Aotearoa. Kei te tūtohi e whai ake nei te tokomaha o ngā ākonga tāne me ngā ākonga wahine e kuraina ana ki te kura tuatoru i te tau 2017 ki te tau 2020.

	2017	**2018**	**2019**	**2020**
Te tokomaha o ngā ākonga tāne	18 168	18 192	18 296	18 065
Te tokomaha o ngā ākonga wahine	24 134	24 525	24 746	24 760

(i) I tēhea tau, mai i te tau 2017 ki te tau 2020, i nui katoa ai te pānga riterite o ngā ākonga tāne e kuraina ana ki Waipapa Taumata Rau?

Tautokona tō whakautu ki ngā tātaihanga me ngā whakaaro tauanga.

(ii) Tuhia ngā take E RUA i noho ai ngā pānga riterite, i tātaia rā i te wāhanga (i) o te tūponotanga motuhenga o ngā ākonga tāne ki Waipapa Taumata Rau i taua tau, hei whakatau tata anake.

Te Take Tuatahi:

Te Take Tuarua:

QUESTION TWO

(a) The University of Auckland | Waipapa Taumata Rau is the largest university in New Zealand. The following table shows the number of male and female students attending the university from 2017 to 2020.

	2017	2018	2019	2020
Number of male students	18 168	18 192	18 296	18 065
Number of female students	24 134	24 525	24 746	24 760

(i) Which year, from 2017 to 2020, had the greatest proportion of male students attending Auckland University?

Support your answer with statistical calculation(s) and reasoning.

(ii) Provide TWO reasons why the proportions calculated from part (i) are only estimates of the true probability of a student being male at Auckland University in that year.

Reason One:

Reason Two:

(b) I waenga i ia 50 ākonga tau tuatahi i Te Whare Wānanga o Waitaha i te tau 2021, e 9 i uru atu ki ngā kōwae ako kāore nei ōna whakamātautau i tōna mutunga.

I waenga i ngā ākonga i uru atu ai ki ngā kōwae ako i whai whakamātautau rā i tōna mutunga, i rite tonu tā te 38% ākonga tae ā-tinana atu ki ngā kauwhau.

I waenga i ngā ākonga i uru atu ai ki ngā kōwae ako kāore nei ōna whakamātautau i tōna mutunga, i rite tonu tā te 21% ākonga tae ā-tinana atu ki ngā kauwhau.

Kia noho ko E hei tūāhua mō te ‘uru atu a te ākonga ki tētahi kōwae ako i whai whakamātautau rā i tōna mutunga’, ā, ko A hei tūāhua mō te ‘rite tonu o te tae atu a te ākonga ki ngā kauwhau’.

(i) I kōwhiri matapōkeretia tētahi ākonga tau tuatahi nō Te Whare Wānanga o Waitaha i te tau 2021.

Tātaia te tūponotanga e rite tonu ana tana tae atu ki ngā kauwhau.

(ii) I whakapono tētahi ākonga ko te $P(E \cap A) + P(E' \cap A') = 1$.

Whakamāramatia, mā roto i te whakaaro tauanga, te tika rānei o tā taua ākonga.

(b) For every 50 first-year students at the University of Canterbury | Te Whare Wānanga o Waitaha in 2021, 9 took courses that did not have final examinations.

For students who took courses that had final examinations, 38% of students attended lectures regularly in person.

For students who took courses that did not have final examinations, 21% of students attended lectures regularly in person.

Let E be the event 'student took a course with a final examination' and A be the event 'student attended lectures regularly'.

(i) One first-year student from Canterbury University in 2021 is selected at random.

Calculate the probability that they attended lectures regularly.

(ii) A student believed that $P(E \cap A) + P(E' \cap A') = 1$.

Explain, using statistical reasoning, whether this student was correct.

(iii) Tokowhā ngā ākonga tau tuatahi i te tau 2021 ka kōwhiri matapōkeretia i Te Whare Wānanga o Waitaha.

Tātaia te tūponotanga ka uru atu te tokotoru i waenga i te tokowhā ki tētahi kōwae ako kāore nei ōna whakamātautau i te mutunga, ka mutu, i rite tonu tana tae atu ki ngā kauwhau.

Whakamāramatia āu nā whakatau.

Ā,

Tuhia tētahi raru tērā pea ka puta i a koe e whakamahi ana i ngā putanga o taua tātaihanga ki ngā ākonga katoa e uru atu ana ki ngā kōwae ako tau tuatahi i te tau 2022.

(iii) Four first-year students in 2021 are chosen at random from Canterbury University.

Calculate the probability that three of the four students took a course without a final examination and attended lectures regularly.

Explain any assumptions made.

AND

Comment on one potential issue when applying the result of this calculation to all students taking first-year courses in 2022.

TE TŪMAHI TUATORU

(a) E whai ake nei te āhua o tētahi tauwaka whānui o Aotearoa (kāore i whakahāngaitia ki te takitahi), ka mutu, ko te ono te mōrahi o ngā pūtohu.

https://upload.wikimedia.org/wikipedia/commons/8/8d/NEW_ZEALAND%2C_2002_-AAA-000_SERIES%2C_OLD_TALL_DIES%2C_LICENSE_PLATE_-_Flickr_-_woody1778a.jpg

E tohu ana ngā pūtohu e toru o te upoko i te wā i rēhitatia tuatahitia ai te waka ki a Waka Kotahi. Ko ngā pūtohu e toru o te remu he mati tau i te 0 ki te 9.

I te tūhura tētahi akomanga o te Kaupae 3 mō te Tauanga i te ōrite rānei o te tūpono puta o ngā tau mati i ngā tauwaka whānui o Aotearoa. I pēnei mā te titiro ki tētahi pae tukutuku e hoko atu ana i ngā waka puta noa i Aotearoa, i roto hoki i ngā rohe katoa o te motu.

(i) Kāore he paku mōhiotanga o ngā ākonga ki te horahanga o ngā tau mati i ngā tauwaka whānui o Aotearoa i mua i te tīmatanga.

Ko te aha te tūponotanga, ā-ariā nei, e tinga ana, ka tukuna e rātou ki te putanga mai o ia tau mati?

Parahautia tō whakautu mā roto i ngā whakaaro tauanga.

QUESTION THREE

(a) A standard New Zealand car number plate (non-personalised) looks like the following with a maximum of six characters.

https://upload.wikimedia.org/wikipedia/commons/8/8d/NEW_ZEALAND%2C_2002_-AAA-000_SERIES%2C_OLD_TALL_DIES%2C_LICENSE_PLATE_-_Flickr_-_woody1778a.jpg

The first three characters are letters that give an indication of when the car was first registered with Waka Kotahi | New Zealand Transport Agency (NZTA). The final three characters are numerical digits from 0 to 9.

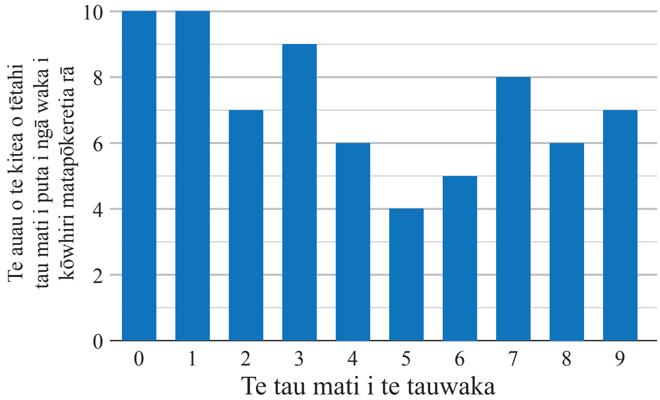
A Level 3 Statistics class were investigating whether the numerical digits on standard New Zealand number plates are equally likely to occur. They did this by looking at a website that sells cars across New Zealand, in every region of the country.

(i) The students had no prior knowledge of the distribution of the numbers on standard New Zealand car number plates.

What is the theoretical probability that they were most likely to give to each digit appearing?

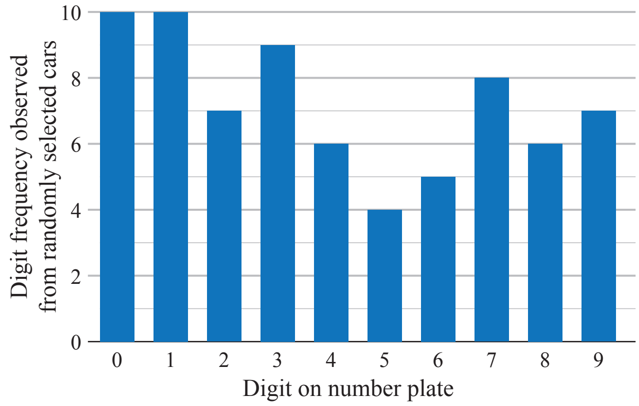
Justify your answer with statistical reasoning.

I whakaputa tētahi ākonga o te akomanga i tētahi whakaahua o āna raraunga, e whakaaturia nei i te kauwhata pou e whai ake nei.



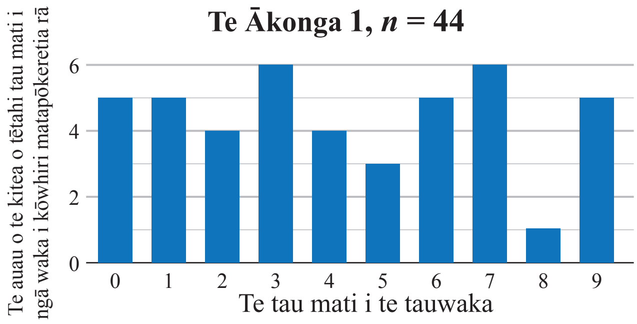
(ii) Nā runga i ngā raraunga e whakaaturia ana i tā te ākonga kauwhata, tātaia te tūponotanga ka puta tētahi tau e 5 ana te uara, e nui ake ana rānei, engari kei raro iho i te 8.

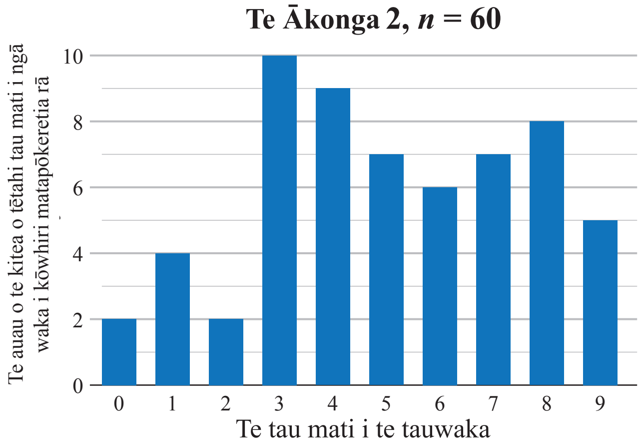
One student in the class produced a visualisation of their data, shown in the following bar chart.

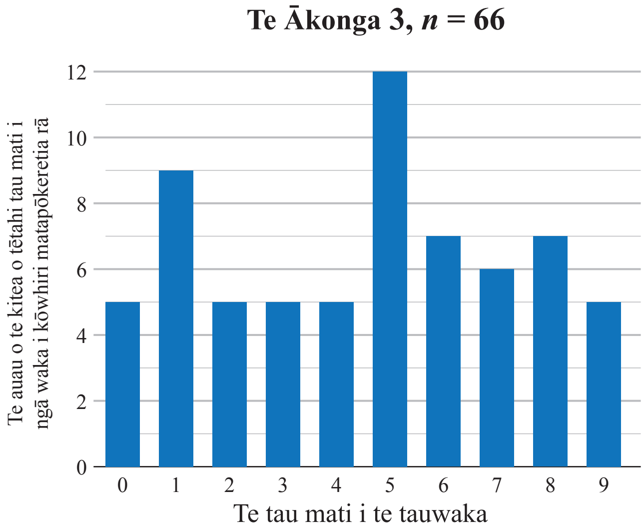


(ii) From the data given in the student's visualisation, calculate the probability a digit on the number plate was 5 or higher, given it was less than 8.

(b) Kei raro iho nei ngā whakaahua a ngā ākonga e toru mai i ā rātou kohinga raraunga, tae atu ki te tapeke o ngā waka i ahu mai ai aua kohinga raraunga (*n*).



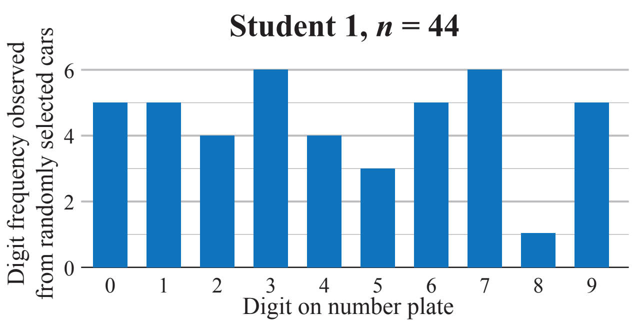


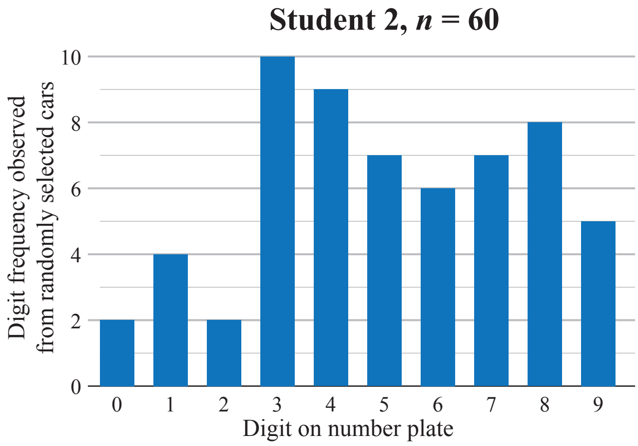


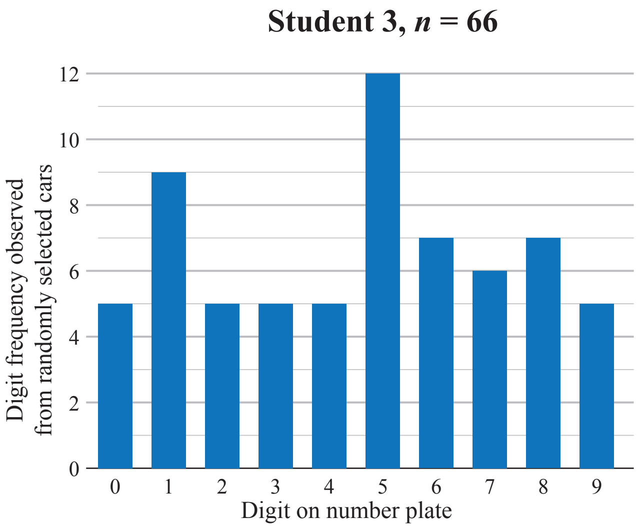
(i) Hei tā Ākonga 1, i āta rapu tērā atu tokorua i ngā tauwaka e whai ana i te tau mati o te 8.

Mā roto i te whakaaro tauanga me ngā tātaihanga, arotakehia te kōrero a Ākonga 1.

(b) Three other students' visualisations from their data collection are shown below, along with the total number of cars they collected data for (n).







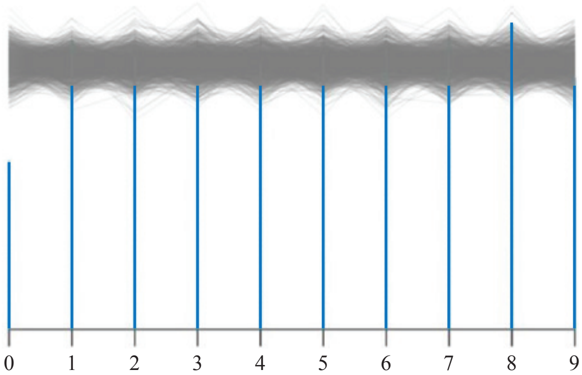
(i) Student 1 claimed that the other two students must have deliberately looked for number plates with the digit 8 on them.

Using statistical reasoning with calculations, evaluate the claim made by Student 1.

(ii) Whakamāramatia, mā roto i te whakaaro tauanga, te take e kore nei e taea te whakatau te korenga i ōrite o te kitea o ngā mati tau i ngā tauwaka whānui o Aotearoa, nā runga i ngā putanga e whakaaturia ana i ngā kauwhata pou kei te whārangi 16 me te whārangi 18.

(c) I whakatōpūhia e te kaiako o te akomanga ngā putanga katoa a ngā tauira katoa. Kotahi mano ngā tukunga o aua putanga ki tētahi hoahoa waihanga, i runga i te whakaaro ka ōrite te kitea o ngā tau mati ki ngā tauwaka whānui o Aotearoa.

E 2764 katoa ngā tau mati i kohia e te katoa o te akomanga. Kei te hoahoa kei raro iho nei ngā putanga o te hoahoa waihanga. E tohu ana ngā pou kikorangi i te auau o te putanga o ia tau mati i kitea ai e te akomanga. E tohu ana te tāhei kiwikiwi i te whānuitanga o te matapaetia o te putanga o ia tau mati, i runga i te tapeke o ngā tau mati e 2764 katoa me te tūponotanga o te 1/10 ka puta ia tau mati.

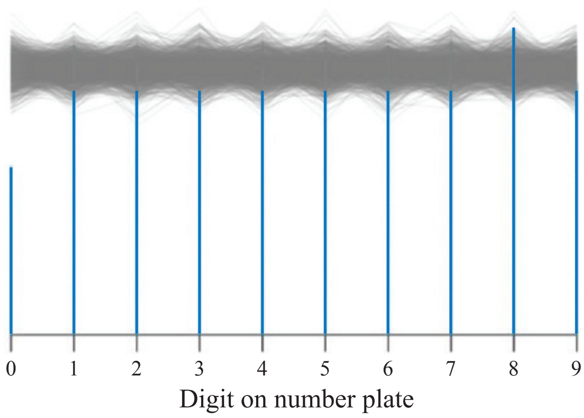


Mā te whakamahi i te whakaaro tauanga me ngā ariā mō te tūponotanga motuhenga, mō te tūponotanga hoahoa, mō te tūponotanga whakamātau anō hoki, he aha ngā whakatau ka taea mō ngā whakaaro e pā ana ki te ōrite o te putanga o ngā tau mati i ngā tauwaka whānui o Aotearoa?

(ii) Explain, using statistical reasoning, why it is not possible to conclude from the results shown in the bar charts on pages 16 and 18 that digits on standard New Zealand number plates are not equally likely to occur.

(c) The teacher of the class grouped all the class's results together. They were then run through a simulation model 1000 times assuming that digits on standard New Zealand car number plates are equally likely to occur.

The total number of digits collected in the whole class was 2764. The diagram below shows the results of the simulation model. The blue vertical lines show the relative frequencies of each digit observed by the class. The grey band shows the variation expected for each digit, based on a total of 2764 digits and 1/10 probability for each digit.



Using statistical reasoning and the ideas about true probability, model probability, and experimental probability, what conclusions can be drawn about the assumption that numerical digits on standard New Zealand car number plates are equally likely to occur?

He whārangi anō ki te hiahiatia.
Tuhia te tau tūmahi mēnā e hāngai ana.

TE TAU TŪMAHI

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER

English translation of the wording on the front cover

Level 3 Mathematics and Statistics (Statistics) 2022

91585M Apply probability concepts in solving problems

Credits: Four

91585M

Achievement	Achievement with Merit	Achievement with Excellence
Apply probability concepts in solving problems.	Apply probability concepts, using relational thinking, in solving problems.	Apply probability concepts, using extended abstract thinking, in solving problems.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Show ALL working.

Make sure that you have the Formulae and Tables Booklet L3–STATMF.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–23 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area ( ). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.