91586M

915865

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

3

SUPERVISOR'S USE ONLY

Te Pāngarau me te Tauanga (Tauanga), Kaupae 3, 2018

91586M Te whakahāngai i ngā tuari tūponotanga hei whakaoti rapanga

9.30 i te ata Rāpare 22 Whiringa-ā-rangi 2018
Whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakahāngai i ngā tuari tūponotanga hei whakaoti rapanga.	Te whakahāngai i ngā tuari tūponotanga mā te whakaaro whaipānga hei whakaoti rapanga.	Te whakahāngai i ngā tuari tūponotanga mā te whakaaro waitara hōhonu hei whakaoti rapanga.

Tirohia mēnā 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 mahinga KATOA.

Tirohia mēnā kei a koe te Pukapuka Tikanga Tātai me ngā Tūtohi L3–STATMF.

Mēnā ka hiahia whārangi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i te tau tūmahi.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–21 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

ME HOATU RAWA KOE I TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI

MĀ TE KAIMĀKA ANAKE

(a) Ko te tau toharite o ngā īmēra ka whiwhi i te haora i tētahi pūkete īmēra he 1.3.

(i) Mā te whakamahi i tētahi tauira tuari tūponotanga tōtika, tātaihia tētahi whakatau tata mō te tūponotanga ka whiwhi tēnei pūkete īmēra i te kore, i te kotahi anake rānei o ngā īmēra i te haora.

(ii) Mā te whakamahi i tētahi tauira tuari tūponotanga tōtika, tātaihia tētahi whakatau tata mō te tūponotanga ka whiwhi tēnei pūkete īmēra i ngā īmera e rua i te iti rawa mai i te 8 i te ata ki te 11 i te ata.

(iii) Mō te whakamahi i te tuaritanga i te wāhanga (a)(i) me te (a)(ii), me puta kia kotahi te whakapaenga i te iti rawa.

Tautohua kia KOTAHI te whakapaenga kei te hē pea, ā, matapakihia te take e pēnei ana.

QUESTION ONE

ASSESSOR'S USE ONLY

(a) The mean number of emails per hour received by one email account is 1.3.

(i) Using an appropriate probability distribution model, calculate an estimate for the probability that this email account receives either zero or one email during any hour.

(ii) Using an appropriate probability distribution model, calculate an estimate for the probability that this email account receives at least two emails during 8 a.m. to 11 a.m.

(iii) To apply the distribution used in parts (a)(i) and (a)(ii), at least one assumption needs to be made.

Identify ONE such assumption that may be invalid and discuss why this is the case.

MĀ TE KAIMĀKA ANAKE

(b) E whakaatu ana te tūtohi i raro nei i te tuari tūponotanga o te taurangi matapōkere M, arā, te maha o ngā waea pūkoro a tētahi tangata kotahi.

m	0	1	2	3
P($M = m$)	0.09	0.63	0.22	0.06

Me kī, i te toharite, he $130 te utu mō ia waea pūkoro.

(i) Tāitahia te utu e tūmanakohia ana mō ngā waea pūkoro a te tangata kotahi.

(ii) Me kī ko te taurangi matapōkere N te maha o ngā pūkete īmēra a te tangata kotahi.

Mō te taurangi matapōkere N, SD(N) = 1.4.

Me whakaatu he nui ake te ine mahora o N i a M, ā, ka homai kia KOTAHI te pūtake pea e pēnei ana.

(iii) SD($M + N$) = 1.893.

He wehe kē a M me N?

Tautokona tō tuhinga ki ngā tauākī me ngā tātaitanga tauanga e tōtika ana.

ASSESSOR'S USE ONLY

(b) The table below shows the probability distribution of the random variable M, the number of mobile phones owned by one person.

m	0	1	2	3
$P(M = m)$	0.09	0.63	0.22	0.06

Suppose that, on average, each mobile phone costs $130.

(i) Calculate the expected cost of the mobile phones owned by one person.

(ii) Let the random variable N be the number of email accounts held by one person.

The random variable N has $SD(N) = 1.4$.

Show that N has a larger standard deviation than M and give ONE reason why this might be the case.

(iii) $SD(M + N) = 1.893$.

Are M and N independent?

Support your answer with appropriate statistical statements and calculations.

TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) Ko te roa o te wā mō te uta i tētahi whārangi tukutuku tētahi ine hei whakatau i te mahinga a te paetukutuku. I kitea e tētahi rangahau o nā noa nei e 46 ōrau o ngā kaiwhakamahi kāore i hoki atu ki ngā paetukutuku kāore i te pai te mahinga.

(i) 12 ngā tāngata i toro atu ki tētahi paetukutuku he koretake te mahinga.

Mā te whakamahi i tētahi tauira tuari tūponotanga tōtika, tātaihia he whakatau tata mō te tūponotanga kāore i hipa atu i te haurua o ēnei tāngata kāore e hoki anō ki tēnei paetukutuku.

(ii) Homai kia RUA ngā pūtake he aha koe i tīpako ai te tauira tuari tūponotanga i te wāhanga (i).

1.

2.

QUESTION TWO

ASSESSOR'S USE ONLY

(a) The time it takes for a web page to load is one measure used to determine a website's performance. A recent study found 46 per cent of users do not revisit poorly performing websites.

(i) 12 people visit a poorly performing website.

Using an appropriate probability distribution model, calculate an estimate for the probability that no more than half of these people do not revisit this website.

(ii) Give TWO reasons why you selected the probability distribution model in part (i).

1.

2.

(iii) I hangaia e tētahi kamupene ngā putanga e rua o tā rātou paetukutuku (A me B), ā, ka tahuri matapōkeretia ngā tāngata ki tētahi o ēnei putanga i tā rātou toro i te paetukutuku. O ngā manuhiri i tahuritia ki te putanga A o te paetukutuku, 20% kāore i hoki anō ki te paetukutuku. O ngā manuhiri i tahuritia ki te putanga B o te paetukutuku, 45% kāore i hoki anō ki te paetukutuku. Me kī, 10 ngā manuhiri hou ki te paetukutuku i tahuri matapōkeretia ki te putanga A o te paetukutuku, ā, 10 atu anō ngā manuhuri hou ki te paetukutuku i tahuri matapōkeretia ki te putanga B o te paetukutuku.

Mā te whakamahi i ngā mōhiohio i runga ake me tētahi tauira tuaritanga tōtika, tātaihia tētahi whakatau tata mō te tūponotanga kotahi i te iti rawa o ēnei manuhiri 20 kāore mō te hoki anō ki te paetukutuku, ā, ka matapaki he aha e taea ai te wehe kē te whakapae i tēnei āhuatanga.

MĀ TE KAIMĀKA ANAKE

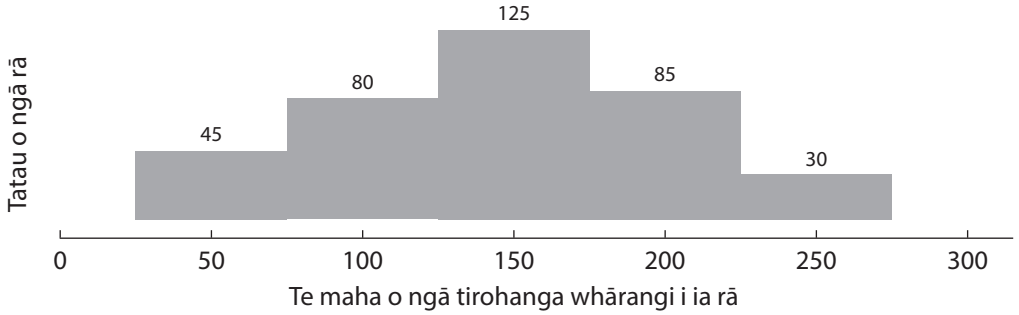
ASSESSOR'S USE ONLY

(iii) A company created two versions of their website (A and B), and randomly redirected people to one of these versions when they visited the website. Of the visitors redirected to version A of the website, 20% did not revisit the website. Of the visitors redirected to version B of the website, 45% did not revisit the website. Suppose 10 new visitors to the website are randomly redirected to version A of the website and another 10 new visitors to the website are randomly redirected to version B of the website.

Using the information given above and an appropriate distribution model, calculate an estimate for the probability that at least one of these 20 visitors does not revisit the website, and discuss why independence can be assumed in this situation.

(b) I tuhia te maha o ngā tirohanga i te whārangi i whiwhi te paetukutuku i ia rā mō ngā rā 365. I whakamahia ēnei raraunga ki te waihanga i te kauwhata i raro.

MĀ TE KAIMĀKA ANAKE



(i) E kī ana te rangatira o te paetukutuku i whiwhi te paetukutuku i ngā tirohanga whārangi i waenga i te 75 me te 225 i te 95% o ngā rā.

- Me whakaatu kei te hē te rangatira o te paetukutuku, ā,
- ka whakaatu ko ngā uara o raro me runga mō te 95% o waenga o ngā tirohanga whārangi he tata ki te 35 mō raro me te 260 mō runga.

Ka taea e koe te tuhi ki te kauwhata i runga hei āwhina i ō tātaitanga.

Me kī i whakamahia tētahi tuaritanga tapatoru hei tauira mō te maha o ngā tirohanga whārangi i whiwhi te paetukutuku i ia rā.

MĀ TE KAIMĀKA ANAKE

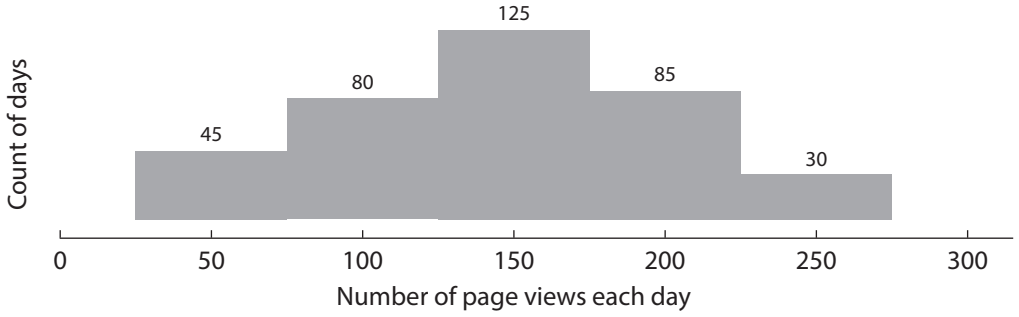
(ii) E ai ki ngā raraunga kei te whārangi 10, homai ngā tāwhā mō tētahi tauira tuaritanga tapatoru.

(iii) Whakamāramahia mai mēnā me whakamahi tētahi whakatika i te motukoretanga ina tātai ana i tētahi whakatau tata mō te tūponotanga neke atu i te 150 ngā tirohanga whārangi ka whiwhi te paetukutuku āpōpō, mā te whakamahi i tō tauira tuaritanga tapatoru i te wāhanga (b)(ii).

Tautokona tō tuhinga ki ngā tātaitanga e whakataurite ana i te whakamahi me te kore whakamahi o tētahi whakatika i te motukoretanga.

ASSESSOR'S USE ONLY

(b) The number of page views the website received each day was recorded over 365 days. This data was used to construct the graph below.



(i) The owner of the website states that the website received between 75 and 225 page views on 95% of the days.

- Show that the website owner is wrong, and,
- show how the lower and upper values for the central 95% of page views could be approximately 35 and 260 respectively.

You can draw on the graph above to help you with your calculations.

Suppose that a triangular distribution was used as a model for the number of page views the website receives each day.

ASSESSOR'S USE ONLY

(ii) Based on the data shown on page 12, give parameters for a triangular distribution model.

(iii) Explain whether a continuity correction needs to be used when calculating an estimate for the probability that the website receives more than 150 page views tomorrow, using your triangular distribution model in part (b)(ii).

Support your answer with calculations that compare the use and the non-use of a continuity correction.

TŪMAHI TUATORU

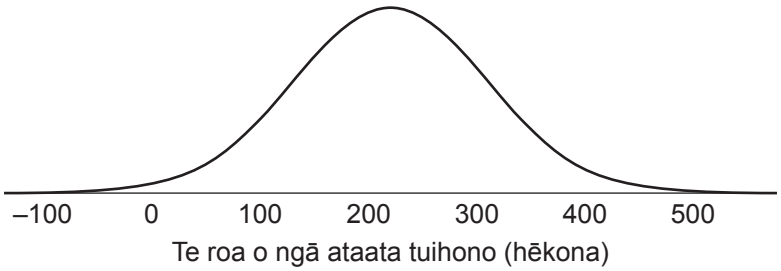
MĀ TE KAIMĀKA ANAKE

(a) I whakatauirahia e ngā kamupene whakatairanga hokohoko e rua te roa (ā-hēkona) o ngā ataata tuihono.

I whakamahia e Kamupene A tētahi tuari māori me te tau toharite o te 220 hēkona me tētahi ine mahora o te 90 hēkona, ā, i whakamahia e te Kamupene B tētahi tuari māori me te tau toharite o te 200 hēkona me tētahi ine mahora o te 50 hēkona.

(i) E whakaaturia ana te tauira tuari māori mō Kamupene A ki te kauwhata i raro.

Tātuhia te tauira tuari tūponotanga mō Kamupene B ki tēnei kauwhata.



(ii) Mai i ngā raraunga o mua i kitea 10% o ngā ataata tuihono he roa ake i te 330 hēkona.

E ai ki ngā raraunga, ko tēhea te kamupene he pai ake tana tauira mō te roa o ngā ataata tuihono?

Whakamahia te whakaaro whaitake o te tauanga hei tautoko i tō whakautu.

MĀ TE KAIMĀKA ANAKE

(iii) Mā te whakamahi i te tauira a Kamupene A mō te roa o ngā ataata tuihono, tātaihia tētahi whakatau tata mō te tūponotanga he poto ake tētahi ataata tuihono i tīpako matapōkeretia i te 150 hēkona, ina ko te roa kei waenga i te 100 me te 300 hēkona.

(b) Ka taea te roa o ngā pānui hokohoko e whakaaturia ana i te tīmatanga o tētahi ataata tuihono te whakatauira mā tētahi taurangi matapōkere e whai uara ana i waenga i te 3 hēkona me te 43 hēkona. Ko te tino roa pea ka taea mō te pānui hokohoko he 18 hēkona.

Mā te whakamahi i tētahi tauira tōtika, tātaihia tētahi whakatau tata mō te tūponotanga he roa ake i te 30 hēkona ētahi pānui hokohoko e rua i tīpako matapōkeretia.

Ka haere tonu te Tūmahi Tuatoru i te whārangi 18.

QUESTION THREE

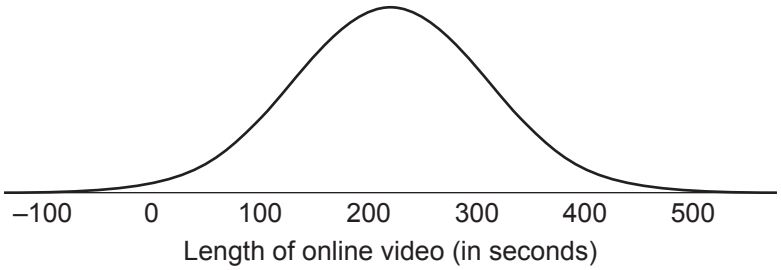
ASSESSOR'S USE ONLY

(a) Two different marketing companies have modelled the length (in seconds) of online videos.

Company A used a normal distribution with a mean of 220 seconds and a standard deviation of 90 seconds, while Company B used a normal distribution with a mean of 200 seconds and a standard deviation of 50 seconds.

(i) The normal distribution model for Company A is shown on the graph below.

Sketch the probability distribution model for Company B on this graph.



(ii) From past data it was found that 10% of online videos are longer than 330 seconds.

Based on this data, which company has a better model for the length of online videos?

Support your answer with statistical reasoning.

ASSESSOR'S USE ONLY

(iii) Using Company A's model for the length of online videos, calculate an estimate for the probability that a randomly selected online video is shorter than 150 seconds, given that its length is between 100 and 300 seconds.

(b) The length of advertisements shown at the beginning of an online video can be modelled by a random variable that takes on values between 3 seconds and 43 seconds. The most likely length of the advertisement is 18 seconds.

Using an appropriate model, calculate an estimate for the probability that two randomly selected advertisements are both longer than 30 seconds.

Question Three continues on page 19.

(c) I tūpono atu tētahi ākonga ki te rapanga i raro nei i a ia e tirotiro tuihono ana i ngā rapanga whakaharatau.

He mea tuari māori[1] te maha o ngā reihana kua whakapouakatia e tētahi kaiahumahi me te tau toharite o te 200 me te ine mahora o te 30.

Matapakitia kia RUA ngā pūtake e kī ana kāore e taea te tauira i marohitia mō te maha o ngā reihana i rō pouaka.

Tautokona tō matapakinga ki ngā tātaitanga me ngā tātuhinga ina hāngai ana.

MĀ TE KAIMĀKA ANAKE

1.

2.

[1] tuari hangarite

(c) A student came across the problem shown below while browsing for practice problems online.

ASSESSOR'S USE ONLY

The number of raisins packed in a box by a manufacturer is normally distributed with a mean of 200 and a standard deviation of 30.

Discuss TWO reasons why the model suggested for the number of raisins in a box is not realistic.

Support your discussion with calculations and sketches where appropriate.

1.

2.

He whārangi anō ki te hiahiatia.
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

TAU TŪMAHI

MĀ TE KAIMĀKA ANAKE

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

English translation of the wording on the front cover

Level 3 Mathematics and Statistics (Statistics), 2018

91586 Apply probability distributions in solving problems

9.30 a.m. Thursday 22 November 2018
Credits: Four

91586M

Achievement	Achievement with Merit	Achievement with Excellence
Apply probability distributions in solving problems.	Apply probability distributions, using relational thinking, in solving problems.	Apply probability distributions, 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–STATF.

If you need more room for any answer, use the space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–21 in the correct order and that none of these pages is blank.

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