Q1. The popliteal height (distance from underside of thigh to sole of foot when seated) of adult males is normally distributed with a mean of 17.0" and a standard deviation of 0.8". What percentage of men will be unable to rest their feet on the floor when sitting on a chair whose seat is 15" from the ground? Assume they wear no shoes or socks.

Q2. An experimenter has reason to believe that subjects' reports of the difference between the lengths of the lines in a Müller–Lyer illusion will be affected by the presence of a stooge who gives a pre-arranged false report. 30 subjects were each presented with the illusion and had to judge, orally, the apparent difference in length of the two lines, in inches. The experimental group were each accompanied by a stooge partner, whereas the control group worked on their own. Each subject's judgement is given below. Is there a significant difference (at the 5% level) between the two groups?

Experimental	–0.41	0.95	0.82	0.44	–0.64	0.76	–0.12	0.41	0.34	0.43	0.08
	–0.57	–0.06	–0.05	0.09							
Control	0.22	–0.17	–0.11	0.19	0.32	0.97	–0.17	–0.79	–0.11	0.05	–0.49
	0.23	0.22	–0.45	–0.28							

Q3. Suppose that on a final exam in statistics the mean score was 50 and the standard deviation (σ) was 10. Find the following:

(a) The standardized (Z) scores of students receiving the following grades: 50, 25, 0, 100, 64
(b) The raw grades corresponding to Z scores of –2, 2, 1.95, –2.58, 1.65, –0.33.

The instructor had reason to believe that the scores were normally distributed. Our of 200 students, how many should he have expected to achieve scores:

(c) within $1 \times \sigma$ of the mean?
(d) 3σ or more above the mean?
(e) between -1.96σ and -0.5σ away from the mean?

Q4. In an experiment to see whether position preferences are heritable in mice, two strains of mice were bred, one selected for left-turning behaviour and the other for right-turning. After ten generations, members of each strain and selected controls are observed in a maze. Their first turns are as follows. Does the experiment demonstrated inherited position preference?

	Right	Left	Total
Bred for R turn	17	9	26
Bred for L turn	13	15	28
Unselected	18	12	30

Q5. After the TV appeal on behalf of the Ski Slopes for the Disabled Fund, cheques were received for the following amounts (in £), and in the order given. Is there a relation between the size of the gift and the promptness with which it was sent off?

1000	120	5	15	10	6.30	10	25	2.50	2	4	0.12	1	1	8

Q6. Suppose that the lecturer in your History of Babylonia course informs you that on the final examination two students received grades of 60 and 30, and that the standardized scores corresponding to those grades were 1 and –1 respectively.

(a) What are the mean and standard deviation of the scores?

(b) If the scores are normally distributed, what proportion of them should lie between 25 and 65?
(c) On the same assumption, between what two scores should the middle 50% of cases lie?

Q7. In a study of reaction time (RT) to an auditory as opposed to a visual stimulus, 20 pairs of Basic Airmen were selected at random. Each pair was matched in physical stature, age, intelligence, and so forth. The members of the pairs were then assigned at random to two experimental conditions. In one, the man was to touch a button as soon as possible after the appearance of a visual stimulus. The other condition was the same except that the stimulus was a buzzer. The average RTs are shown below, in ms. Is there a significant (at 5%) difference in RT to the different types of stimuli?

Pair	1	2	3	4	5	6	7	8	9	10
Auditory RT	130	200	150	140	230	160	180	150	200	170
Visual RT	160	130	120	150	120	160	110	210	170	140
Pair	11	12	13	14	15	16	17	18	19	20
Auditory RT	220	140	220	230	180	190	180	210	230	220
Visual RT	170	160	110	290	100	190	210	180	170	160

Q8. A subject has to set the two sides of a rectangle to be visually equal on a number of trials. The table gives the time taken for each adjustment (in sec) and the error (in mm). Is there any relation between the time taken in adjustment and size of error?

Trial	1	2	3	4	5	6	7	8	9	10	11	12
Time	17	8	11	24	9	15	20	12	35	9	14	17
Error	4.4	5.7	4.0	4.2	3.6	1.9	2.9	5.3	4.1	6.3	0.8	2.0

Q9. The following are the wavelenghts (in nm) for maximum visual sensitivity of fiteen colour-normal observers and eight deuteranopes (colour-blind individuals lacking the 'green' pigment). Do these data show any difference between the two groups?

Colour-normals	560	558	563	561	552	557	562	560	569	559
	564	554	559	560	556					
Deuteranopes	561	567	559	570	564	555	566	561		

Q10. IQ is defined to be normally distributed with mean 100 and standard deviation 15. What IQ is high enough for only 100,000 people in England and Wales (take population to be 50,000,000) to exceed it? How many people lie between 95 and 105? Between 60 and 70?

Q11. A psychologist was interested in the verb–adjective ratio as an index of individual speech habits. 10 science and 12 arts students were chosen at random, and a sample of free speech of each subject obtained. Each sample was scored according to the number of verbs used divided by the number of adjectives. The data are shown below. Do science students have a significantly higher verb–adjective ratio?

Sci	1.32	2.30	1.98	0.59	1.02	1.88	0.92	1.39	1.95	1.25		
Arts	1.04	0.93	0.75	0.33	1.62	0.76	0.97	1.21	0.80	1.16	0.71	0.96

Q12. Four large US midwestern universities were compared with respect to the fields in which graduate degrees were given. The graduation rolls for last year from each university were taken and the results put into the contingency table below. Is there a significant association (at the 5% level) between the university and the fields in which it awards degrees? What are we assuming when we carry out this test?

University	Law	Medicine	Sciences	Humanities	Other
A	29	43	81	87	73
B	31	59	128	100	87
C	35	51	167	112	252
D	30	49	152	98	215

Q13. In the Tripos examination for Part II Neurobotany, male (M) and female (F) candidates are placed in the order shown below (highest marks first). Do either men or women make better neurobotanists, insofar as this elusive quality is measured by the examination?

M M F M M M F F M F M F F M M M M M F M

Q14. A number of 30-second samples were taken from each of three TV channels, and classified according to whether the subject matter was primarily sex, violence, or general interest. The table below shows how many were in each category. Do these data show a significant difference in the contents of the three channels?

	Sex	Violence	General interest	Total
BBC1	26	17	57	100
BBC2	17	5	38	60
ITV	19	33	48	100

Q15. On each trial of a discrimination experiment, a monkey was watched for neck-scratching and tooth-baring behaviour. These occurred on the numbers of trials shown below. Do these data show any connection between neck-scratching and tooth-baring?

Neck-scratching alone	46
Tooth-baring alone	22
Neck-scratching and tooth-baring	5
Neither	53

Q16. In a study of demographic trends, 26 newly-married couples were asked, one individual at a time, how many children they would like to have. Responses are listed below. What can be concluded from these data? (Note that at least four different tests can be applied. To what question is each appropriate?)

Couple	1	2	3	4	5	6	7	8	9	10	11	12	13
Husband	3	0	1	2	0	0	1	2	2	1	8	0	3
Wife	2	1	0	2	3	3	2	3	3	2	4	1	4
Couple	14	15	16	17	18	19	20	21	22	23	24	25	26
Husband	5	7	1	0	4	10	5	2	0	1	3	5	2
Wife	2	2	2	3	4	3	3	4	2	3	2	2	1

Q17. Ten subjects were tested on a high-speed sorting task while subjected to 100 dB SPL white noise through earphones. On session 1 and 4 the test was preceded by a period of 115 dB SPL noise and on sessions 2 and 3 by 85 dB SPL noise. Their error scores are shown below. Does the intensity of the preceding noise have a significant effect on task performance?

Subject	1	2	3	4	5	6	7	8	9	10
Errors in 2 & 3	37	29	60	44	21	47	46	38	28	66
Errors in 1 & 4	24	24	31	30	26	42	33	19	32	45

Q18. The following are percentages of a group of 15 subjects on (a) a motor-tracking test and (b) the Body Image Awareness scale. Is there any relationship between the two scores?

Subject	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Tracking	74	31	80	66	41	53	77	39	46	19	55	62	38	49	59
BIAS	43	60	51	53	57	70	39	85	68	73	54	48	59	39	87

Q19. A die is thrown 300 times, each face appearing uppermost on the number of times shown below. Would you accuse the owner of having a loaded die?

Face	1	2	3	4	5	6
No. of throws	42	37	58	44	61	58

Q20. Fifteen sea slugs are placed on a line perpendicular to a gradient of light intensity. After two minutes their distances from the line are as shown below (cm; +ve distances are towards the light). Do the slugs show a significant tendency to be phototropic?

+13	+21	+5	–1	+3	–7	+12	+9	+24	–19	+21	+11	+48	–8	+15

Q21. In an experiment on the effects of context on letter perception in reading, a subject has to cross out every letter ‘e’ she spots in a page of the *Times*, working as fast as possible. For *e*s in contexts where they have the sounds as in ‘evil’, ‘belt’, and unstressed ‘the’, she misses 17 out of 243, 64 out of 409, and 99 out of 688, respectively. For silent *e*s she misses 108 out of 595. Are there significant differences in the proportions missed in the four different pronunciations?

Q22. In a sample of 1000 people in a mass eye-testing program, the numbers needing various powers of corrective lenses are as follows (power in dioptres, for right eye only). Do these powers deviate significantly from a normal distribution? ***This question is well beyond the standard required for the exam!***

–5D	–4D	–3D	–2D	–1D	0	+1D	+2D	+3D	+4D	+5D
11	29	41	67	106	532	133	40	22	14	5