1 Two randomly selected groups of students, with similar ranges of abilities, take the same examination in different rooms. One group of 140 students takes the examination with background music playing. The other group of 210 students takes the examination in silence. Each student is awarded a grade for their performance in the examination and the numbers from each group gaining each grade are shown in the following table.

		Grade awarded	
	A	В	С
Background music	49	51	40
Silence	93	68	49

Test at the 10% significance level whether grades awarded are independent of whether background music is playing during the examination. [6]	d]

It is claimed that the median time to complete the task is 6.4 milliseconds. (a) Carry out a Wilcoxon signed-rank test at the 5% significance level to test this claim.	
(a) Carry out a Wilcoxon signed-rank test at the 5% significance level to test this claim.	
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(b) State an underlying assumption that is made when using a Wilcoxon signed-rank test.	

 $\mathbf{3}$ The continuous random variable X has probability density function f given by

$$f(x) = \begin{cases} \frac{3}{16}(2 - \sqrt{x}) & 0 \le x < 1, \\ \frac{3}{16\sqrt{x}} & 1 \le x \le 9, \\ 0 & \text{otherwise.} \end{cases}$$

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The random variable *Y* is such that $Y = \sqrt{X}$. **(b)** Find the probability density function of *Y*. [5]

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A company has two different machines, *X* and *Y*, each of which fills empty cups with coffee. The manager is investigating the volumes of coffee, *x* and *y*, measured in appropriate units, in the cups filled by machines *X* and *Y* respectively. She chooses a random sample of 50 cups filled by machine *X* and a random sample of 40 cups filled by machine *Y*. The volumes are summarised as follows.

$$\sum x = 15.2$$
 $\sum x^2 = 5.1$ $\sum y = 13.4$ $\sum y^2 = 4.8$

The manager claims that there is no difference between the mean volume of coffee in cups filled by machine X and the mean volume of coffee in cups filled by machine Y.

Test the manager's claim at the 10% significance level.	[9]
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		19.8	22.1	24.4	21.5	20.8	26.3	23.7	25.0		
		19.8	22.1	24.4	21.3	20.8	20.3	23.1	23.0		
(a)	Assuming population	that dist n mean di	ances ar	e norma nrown is	lly distr more th	ibuted, t an 22.0	est, at tl metres.	ne 5% si	gnificance	level, w	hethei
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A bag contains 4 red balls and 6 blue balls. Rassa selects two balls at random, without replacement,

(a)	Find the probability generating function, $G_X(t)$, of X .	[2]
ias	sa also tosses two coins. One coin is biased so that the probability of a ed so that the probability of a head is p . The probability generating a ds obtained by Rassa, is $G_Y(t)$. The coefficient of t in $G_Y(t)$ is $\frac{7}{12}$.	h head is $\frac{2}{3}$. The other coin is function of Y , the number of
b)	Find $G_{\gamma}(t)$.	[3]

The random variable Z is the sum of the number of red balls selected and the number of heads obtained by Rassa.

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Use the probability gen	nerating function of Z to find $E(Z)$.	