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VCE Mathematical Methods ¾

Discrete Random Variables I [5.1]
Test

31.5 Marks. 1 Minute Reading. 23 Minutes Writing.

Results:

Test Questions	/ 14.5	40
Extension Test Questions	/ 17	





Section A: Test Questions (14.5 Marks)

Question 1 (3.5 marks)

Tick whether the following statements are **true** or **false**.

	Statement	True	False
a.	The sample space represents the set of all possible outcomes.		
b.	Mutually exclusive events can occur simultaneously.		
c.	Independent events can occur simultaneously.		
d.	Independent events do not affect each other's probability and are given by $Pr(A) \times Pr(B) = Pr(A \cup B)$.		
e.	Conditional probability occurs when the sample space is restricted due to the given condition.		
f.	For conditional probability, a Venn diagram is best to use for complicated questions.		
g.	The conditional probability for independent events is the same as the conditional probability for dependent events.		

Question 2 (2 marks)

Two events A and B from a given event space are such that $Pr(A) = \frac{1}{5}$ and $Pr(B) = \frac{1}{3}$.

- **a.** Calculate $Pr(A' \cap B)$ when $Pr(A \cap B) = \frac{1}{8}$. (1 mark)
- **b.** Calculate $Pr(A' \cap B)$ when A and B are mutually exclusive events. (1 mark)

Space for Personal Notes

Question 3 (5 marks)

For events A and B from a sample space, $\Pr(A \mid B) = \frac{1}{5}$ and $\Pr(B \mid A) = \frac{1}{4}$. Let $\Pr(A \cap B) = p$.

- **a.** Find Pr(A) in terms of p. (1 mark)
- **b.** Find $Pr(A' \cap B')$ in terms of p. (2 marks)

c. Given that $Pr(A \cup B) \le \frac{1}{5}$, state the largest possible interval for p. (2 marks)

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Qu	estion 4 (4 marks)
	o boxes each contain four stones that differ only in colour.
	x 1 contains four black stones. x 2 contains two black stones and two white stones.
	box is chosen randomly, and one stone is drawn randomly from it.
	ch box is equally likely to be chosen, as is each stone.
a.	What is the probability that the randomly drawn stone is black? (2 marks)
b.	It is known from which box the stone has been drawn.
	Given that the stone that is drawn is black, what is the probability that it was drawn from Box 1? (2 marks)
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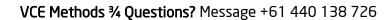


Section B: Extension Test Questions (17 Marks)

Qu	estic	on 5 (11 marks) Tech-Active.
A n	nobi	le phone technician is studying the performance of two brands of phones, Brand A and Brand B .
		phone is sent in for repair, the technician classifies the phone as either" easily repairable" or "difficult to Based on the past records, 60% of all phones are Brand A , and the remaining 40% are Brand B .
The	e tecl	hnician believes:
>	90%	% O(A) = A O(A) + A
>	50%	% of Brand B phones are easily repairable.
		expresent the event that a phone is easily repairable, A represent the event that the phone is Brand A , and B at the event that the phone is Brand B .
a.		
	i.	Find the probability that a phone is easily repairable. (2 marks)
	ii.	Given that a randomly chosen phone is easily repairable, find the probability that it is a Brand A phone. (1 mark)



	phone. (2 marks)
	phone brand, Brand C , is introduced. The technician now records 67% of all phones sent in as easily ble. Brand C makes up 20% of all phones sent in for repair.
	A and <i>B</i> keep the same statistics as above, and the ratio of Brand <i>A</i> phones to Brand <i>B</i> phones that are sepair is 3: 2. Let <i>c</i> be the probability that a randomly chosen Brand <i>C</i> phone is easily repairable.
i.	Find the fraction of phones that are Brand A and the fraction of phones that are Brand B. (2 marks)
l•	That the fraction of phones that are Brand A and the fraction of phones that are Brand B. (2 marks)
ii.	Hence, find the value of c . (2 marks)

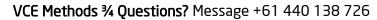




An external agency believes that the technician's assumption about repairability (that 67% of phones are easily repairable) is only valid for phones sent in during the morning. They believe that for phones sent in during the afternoon, the probability that a phone is easily repairable is x, where 0.8 ≤ x ≤ 0.95.
c. Let the probability that a phone is sent in the afternoon be y. If the overall proportion of easily repairable phones observed is 0.78, find the minimum and maximum values of y, assuming the external agency's beliefs are correct. (2 marks)

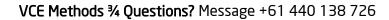
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here are	100 people in line to	ooard a plane with 100	seats. The first per	rson has lost his	boarding pass, s	o he
		nat follows takes their a bability that the last pa				andom
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Question 7 (3 marks)
A man is stranded on an island. A benevolent genie presents three boxes, 23 white marbles and 7 black marbles and instructs the man, "You may distribute the marbles into the boxes any way you see fit, but you must use all of the marbles. Once you finish, you will choose a box at random and then choose a marble from that box at random. If the marble is white, then I will help you escape from this place."
Assuming the man distributes the marbles in his best interest, what is the probability that he escapes the island? And what is the best way to distribute the marbles?
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