1. [5 marks] Let $A = \{4, 7, 8, 9\}, B = \{5, 6, 7, 9\}$ and $C = \{4, 5, 8, 9\}$.

a) Find $(A \cap B) \cup (B \cap C)$

$A \cap B = \{7, 9\}$

$B \cap C = \{5, 9\}$

$(A \cap B) \cup (B \cap C) = \{5, 7, 9\}$

b) Write out all the subsets of A that contain exactly two elements.

$\{4, 7\}$ $\{4, 8\}$ $\{4, 9\}$

$\{7, 8\}$ $\{7, 9\}$ $\{8, 9\}$

2. [2 marks] A six-sided die is rolled twice and we record the total of the two numbers that are rolled. Write out the sample space of this experiment.

The smallest total is $1+1=2$

The largest total is $6+6=12$

$S = \{2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

3. [4 marks] Twelve people apply for a job and eight of them are qualified. How many ways are there to: (12−8=4 unqualified)

a) Select two qualified applicants and two unqualified applicants for an interview

$C(8,2) \times C(4,2) = 168$

Choose 2 qualified from 8 (unordered)

Choose 2 unqualified from 4

b) Select four of the applicants for an interview if we select from the entire group of applicants

$C(12,4) = 495$

c) Rank the qualified applicants from most qualified to least qualified

$8!$ or $P(8,8)$ or $8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$= 40,320$

4. [3 marks] We have three different textbooks (Math, Economics and Statistics) and their solution manuals. We want to arrange these six objects in a row on a bookshelf so that each solution manual is beside the appropriate textbook, either to the left or right. How many different ways are there to do this?

$3! \times 2 \times 2 \times 2 = 48$

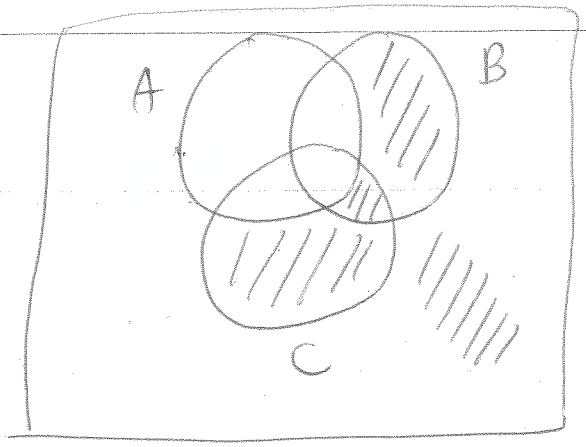
Arrange the 3 subjects

order of Math text and solutions

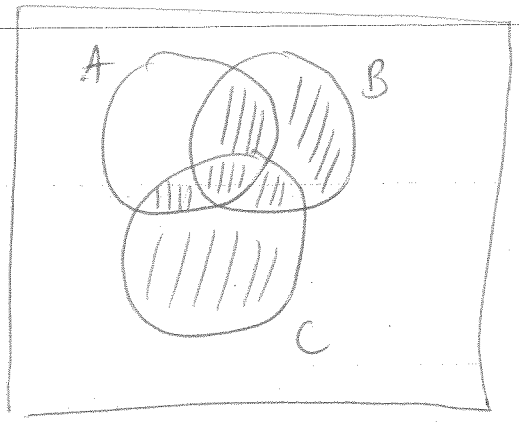
order of Economics text and solutions

order of Statistics text and solutions

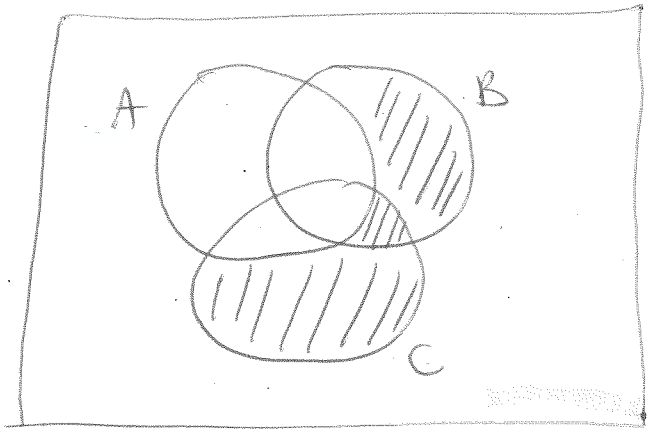
5. [3 marks] Draw a Venn diagram and shade in $A' \cap (B \cup C)$



A'



$B \cup C$



$A' \cap (B \cup C)$

6. [4 marks] An experiment has three possible outcomes: A, B and C. Write down the probability distribution if the probability of A is 0.15 and C is four times as likely as B.

Let $Pr(B) = x$

Outcome	Probability
A	0.15
B	x
C	$4x$

$0.15 + x + 4x = 1$

$0.15 + 5x = 1$

$5x = 0.85$

$x = 0.17$

Outcome	Probability
A	0.15
B	0.17
C	0.68

7. [4 marks] Draw a Venn diagram for the following situation.

Out of 70 students:

23 like to run
25 like to bike
32 like to swim
7 like to run and bike
8 like to run and swim
9 like to bike and swim
4 like to run, bike and swim

R: run
B: bike
S: swim