STAT 260 Summer 2024: Written Assignment 3

Due: Upload your solutions to Crowdmark BEFORE 6pm (PT) Friday May 31.

You may upload and change your files at any point up until the due date of Friday May 31 at 6pm (PT).

A 2% per hour late penalty will be automatically applied within Crowdmark. The penalty is applied in such a way so that assignments submitted 6pm to 6:59pm will have 2% deducted, assignments submitted 7pm-7:59pm will have 4% deducted, etc.

Note that if you submit any portion of your assignment before the deadline, Crowdmark will NOT permit you to edit your submission (including make additional uploads) after the 6pm deadline passes. This means that if, for example, you upload only Question 1 before the deadline, you will not be able to upload Question 2 after the deadline. If you intend to submit late (with penalty) you must submit the entire assignment late.

Submission: Solutions are to be uploaded to Crowdmark. Here you will be asked to upload your solutions to each question separately. Your solution to Question 1 must be uploaded in the location for Question 1, your solution to Question 2 must be uploaded in the location for Question 2, etc. If your work is uploaded to the wrong location, the marker will not be able to grade it.

You may hand-write your solution on a piece of paper or tablet. If you wish to use this question sheet and write your solutions on the page, space has been provided below. One of the quickest ways to upload work is by accessing Crowdmark from within a web browser on a smartphone. In the area where you upload work, press the "+" button. This will give you the option of using a file already on your phone, or you can use the phone camera to photograph your work. If you complete your work on a tablet, save the file as a PDF or each question as a jpeg and drag/drop the file into the Crowdmark box. ***Photographs of laptop/tablet screens will not be graded***; take a proper screenshot.

Instructions: For full marks, your work must be neatly written, and contain enough detail that it is clear how you arrived at your solutions. ***You will be graded on correct notation***. Messy, unclear, or poorly formatted work may receive deductions, or may not be graded at all. Only resources presented in lecture or linked to on the Stat 260 Brightspace page are permitted for use in solving these assignments; using outside editors/tutors, and/or software (include AIs) is strictly forbidden. Talking to your classmates about assigned work is a healthy practice that is encouraged. However, in the end, each person is expected to write their own solutions, in their own words, and in a way that reflects their own understanding.

Additional Instructions:

For each of the following questions, include the correct notation for the probability that you are calculating in your solution, not just the numeric answer. For example: "$P(E \cap F) = 0.157$".

1. **[7 marks]** A small airline offers direct flights from Victoria to Abbotsford, Kelowna, and Calgary, with seating options in either Economy or Business class. The proportion of ticket sales for flights from Victoria are given below:

	Abbotsford (A)	Kelowna(K)	Calgary (C)
Economy (E)	0.31	0.16	0.23
Business (B)	0.09	0.05	0.16

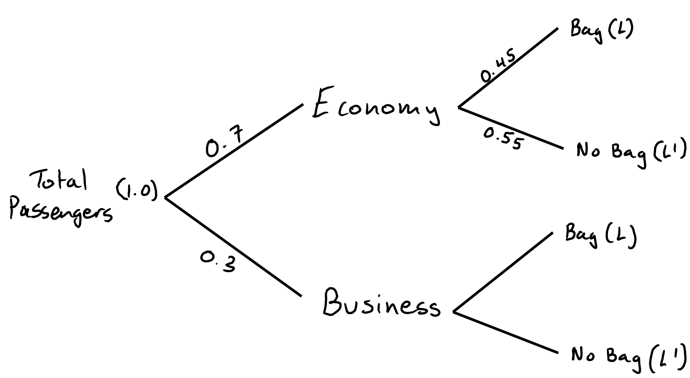
(a) What is the probability that a random passenger on a flight from Victoria is flying Business class and **not** flying to Calgary?

$$P(B \cap C') = P(B \cap A) + P(B \cap K)$$
$$= 0.09 + 0.05$$
$$= 0.14$$

(b) What is the probability that an Economy passenger departing from Victoria has a ticket to Abbotsford or Kelowna?

$$P(E \cap (A \cup K)) = P(E \cap A) + P(E \cap K) = 0.31 + 0.16$$
$$= 0.47$$

(c) Among all of the airline's passengers departing Victoria, 52% check a bag (L). In particular, 45% of the airline's Victoria-departing passengers in Economy (to any destination) check a bag. Using this information, determine the proportion of Business passengers departing Victoria that check a bag. *Include a fully labelled tree diagram (with probabilities) in your solution.*



So we need to find: $P(L|B)$

$\therefore$ Total Probability of checking bags in

$P(L) = P(L|E) \cdot P(E) + P(L|B) \cdot P(B)$

$0.52 = 0.45 \times 0.70 + P(L|B) \cdot 0.30$

$\therefore 0.52 = 0.315 + 0.30 \cdot P(L|B)$

$\therefore 0.52 - 0.315 = 0.30 \cdot P(L|B)$

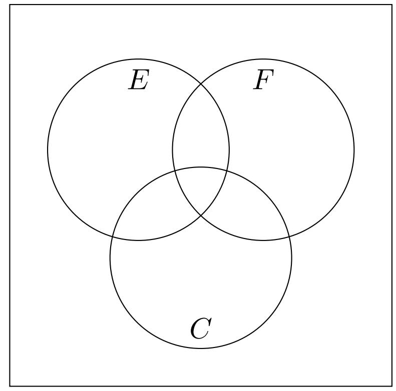
$\therefore \dfrac{0.205}{0.300} = P(L|B)$

$\therefore P(L|B) \approx 0.683$

or

The probability of Business class passengers having checked-in baggage is approximately 68.3%.

2. **[5 marks]** A 911-Response Centre can dispatch police (C), EMTs (E), or firefighters (F) to emergency calls. Among their received calls, records indicate that:



- 55% of calls required police,
- 71% of calls required EMTs,
- 91% of calls required police or EMTs,
- 73% of calls required police or firefighters,
- 82% of calls required EMTs or firefighters,
- 5% of calls required none of the three services.

(a) What is the probability that a random call requires exactly 1 of the 3 services?
Hint: Use the Venn diagram and think about what regions each of the given events occupy.

$P(\text{only } E) = P(E \cup C \cup F) - P(C \cup F)$
$= 0.95 - 0.73$
$= 0.22$

$P(\text{only } C) = P(E \cup C \cup F) - P(E \cup F)$
$= 0.95 - 0.82$
$= 0.13$

$P(\text{only } F) = P(E \cup C \cup F) - P(C \cup E)$
$= 0.95 - 0.91$
$= 0.04$

$P(\text{exactly one}) = 0.22 + 0.13 + 0.04$
$= 0.39$

$\therefore$ The probability of a random call requiring exactly one service is 0.39.

(b) We receive the additional information that 12% of calls required police and EMTs, but not firefighters (do not use this info in part (a)). What is the probability that a random call requires all three services?
Hint: Start by determining $P(E \cap C)$.

Given that $P(C \cap E \cap F') = 0.12$

Finding $P(C \cap E) = P(C \cap E \cap F) + P(C \cap E \cap F')$
$= 0.55 + 0.71 - 0.91$
$= 0.35$

Finally we calculate : $P(C \cap E \cap F)$:
$0.35 = P(C \cap E \cap F) + 0.12$
$P(C \cap E \cap F) = 0.35 - 0.12$
$= 0.23$

So, the probability that a random call requires all three services is 0.23.