MAT1372, Quiz4, Fall2025

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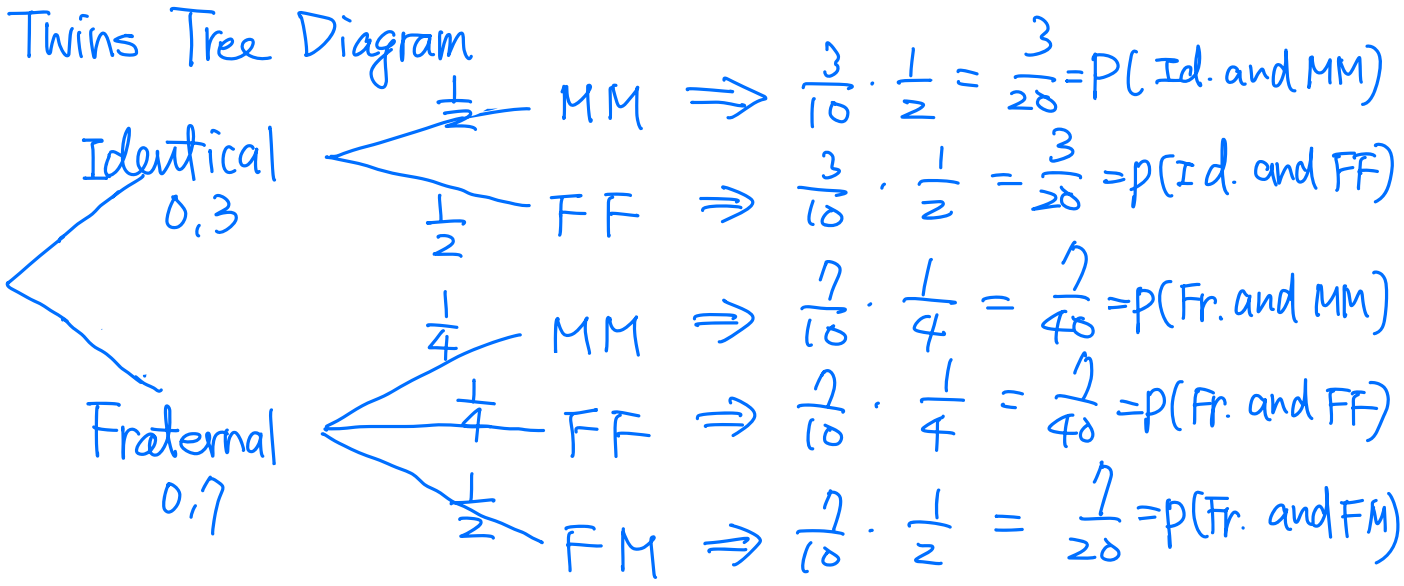
1. About 30% of human twins are identical, and the rest are fraternal. Identical twins are necessarily the same sex – half are males and the other half are females. One-quarter of fraternal twins are both male, one-quarter both female, and one-half are mixes: one male, one female. You have just become a parent of twins and are told they are both girls. Given this information, what is the probability that they are identical? (Hint: Try to use tree diagram)

Twins Tree Diagram



P(Your children are identical given they are both girls)

$$= \frac{P(\text{Id. and FF})}{P(\text{Id. and FF}) + P(\text{Fr. and FF})}$$

$$= \frac{\frac{3}{20}}{\frac{3}{20} + \frac{7}{40}} = \frac{\frac{3}{20}}{\frac{13}{40}} = \frac{3}{20} \cdot \frac{40^{2}}{13} = \frac{6}{13}.$$

Please turn over and finish the rest of the question.

2. Each row in the table below is a proposed grade distribution for a class. Identify each as a valid or invalid probability distribution and explain your reasoning.

	Grades				
	A	B	C	D	F
(a)	0.3	0.3	0.3	0.2	0.1
(b)	0	0	1	0	0
(c)	0.3	0.3	0.3	0	0
(d)	0.3	0.5	0.2	0.1	-0.1
(e)	0.2	0.4	0.2	0.1	0.1

As a valid probability distribution, it needs to satisfy
① each probability is non-negative and less than or equal to 1
② the sum of all probabilities is 1.

For (a), it is invalid because its sum > 1

For (b), it is valid.

For (c), it is invalid because its sum < 1

For (d), it is invalid because $P(F) < 0$.

For (e), it is valid.

End of this quiz.