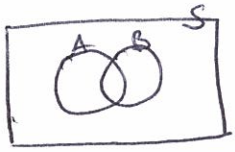
Chapter 12: General Rules of Probability

∪ = OR
∩ = AND

① $0 \le P(A) \le 1$ for any event A.

② $P(S) = 1$ (S = sample space)

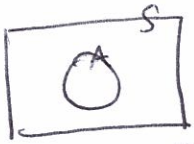


③ $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

(a) if A and B are disjoint, then $A \cap B = \phi$

$\Rightarrow P(A \cap B) = 0$

$\Rightarrow P(A \cup B) = P(A) + P(B)$



④ $P(\text{not } A) = 1 - P(A)$

⑤ $P(A \cap B) = P(A)\,P(B) \Rightarrow$ A and B are independent ($\perp\!\!\!\perp$ symbol)

⑥ $P(B|A) = \dfrac{P(A \cap B)}{P(A)}$ conditional probability (assumes $P(A) > 0$)

"probability of B given A"

$\Leftrightarrow P(A \cap B) = P(B|A)P(A)$

⑦ If $P(B|A) = P(B)$, then $B \perp\!\!\!\perp A$
(and $P(B) > 0$, $P(A) > 0$)

Ex1 I have a drawer full of loose socks. I have a total of 5 blue socks, 3 black socks and 2 red socks. I pull one sock at random, then another sock, trying to find a match.

(a) Draw a tree diagram to illustrate this. Stop when you get a match.

(b) P(Blue, Black) = ?

(c) P(matching pair) = ?

Ex 2 Suppose that 10% of adults belong to health clubs, and 40% of these health club members go to the club at least twice a week. What percent of all adults go to a health club at least twice a week?

Ex 3 Here are approximate probabilities of positive and negative test results when the blood tested does and does not actually contain antibodies to HIV.

	test positive	test negative
antibodies present	0.9985	0.0015
" absent	0.0060	0.9940

Suppose 1% of a large population carries antibodies to HIV in their blood.

(a) Draw a tree diagram for selecting a person from this population.

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Ex 3 (cont)

(b) $P(+\text{test}) = ?$

Ex 4 Suppose that each dog born is equally likely to be a girl or boy dog (and that successive births from one mother are independent).

(a) You know Spot has at least one male dog and has had exactly two dogs. What is conditional probability that Spot had two male dogs?

(b) Sable had two dogs also. Her first dog was a male dog. What is conditional probability that she had 2 male dogs?

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Ex 5 Of all college degrees awarded in the U.S., 50% are Bachelor's degrees, 59% are earned by women, and 29% are Bachelor's degrees earned by women (a) make a venn diagram.

(b) what percent of all degrees are earned by people who are not female?

(c) what percent of all degrees are Bachelor's degrees earned by people not women?

(d) what is conditional probability that a degree is earned by a woman, given that it's a Bachelor's degree?

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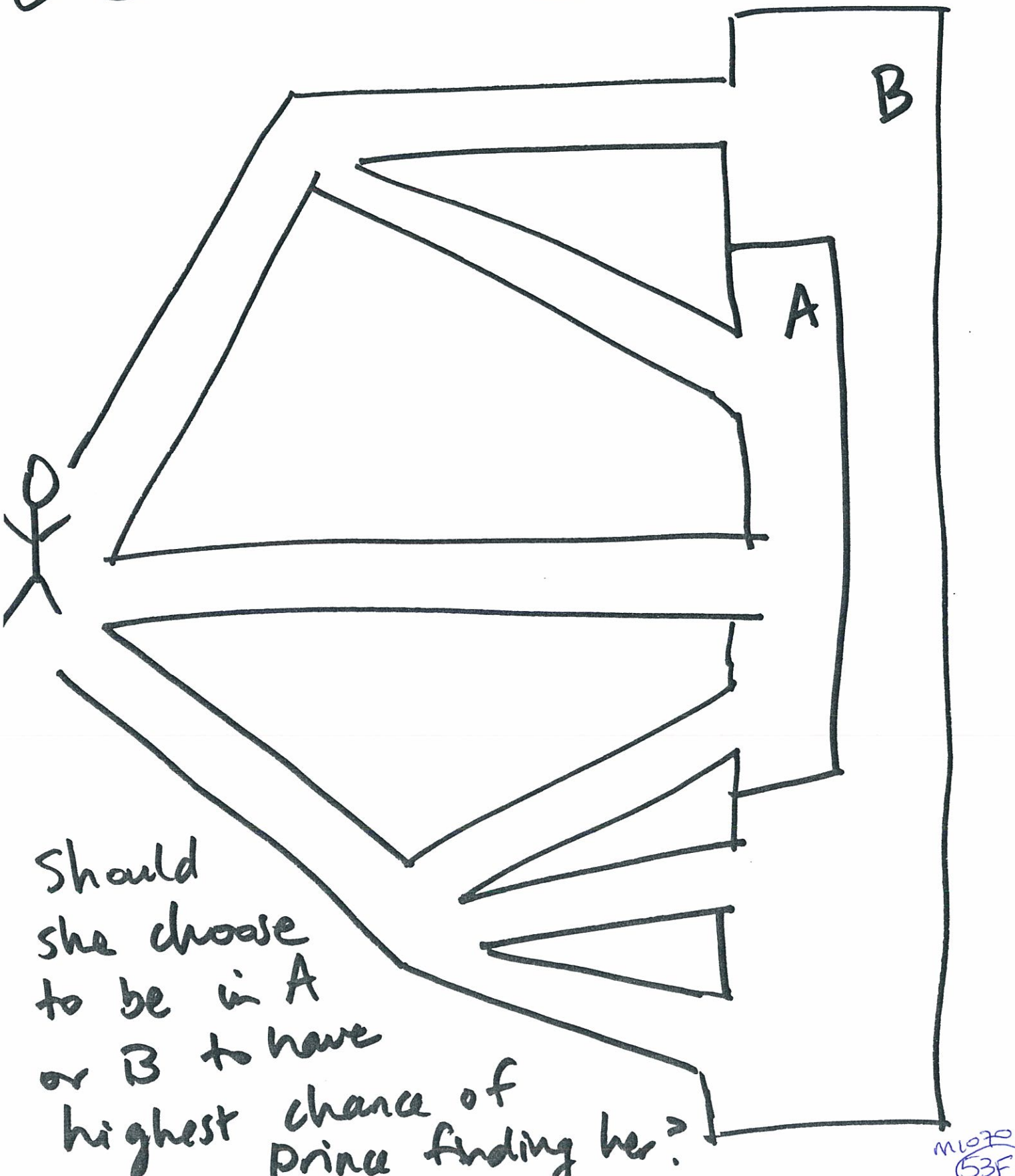
LADY & TIGER MAZE



Should she choose to be in A or B to have highest chance of prince finding her?

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