Probability (ch4)
Research Ethics

- **Class starts at *11:50* due to long chapel**
- **HW2 due Thu 10pm**
- **Set *proposal* mtg time if you haven't by now**

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Outline for today

- Conditional Probability
  - Definition: Bayes' Theorem
  - Statistical independence
- Research Ethics
  - Ethical abuses in the name of research
  - REB exemption rules
  - Principles: respect, welfare, justice
  - Risks
  - Informed consent
  - Completing your REB application

Review: probability

- Box represents whole sample space
- Circles represent events (subsets) within SS
- e.g., for a single trial:

P(SS) = 1

A   **B**

P(A) = .35

P(B) = .15
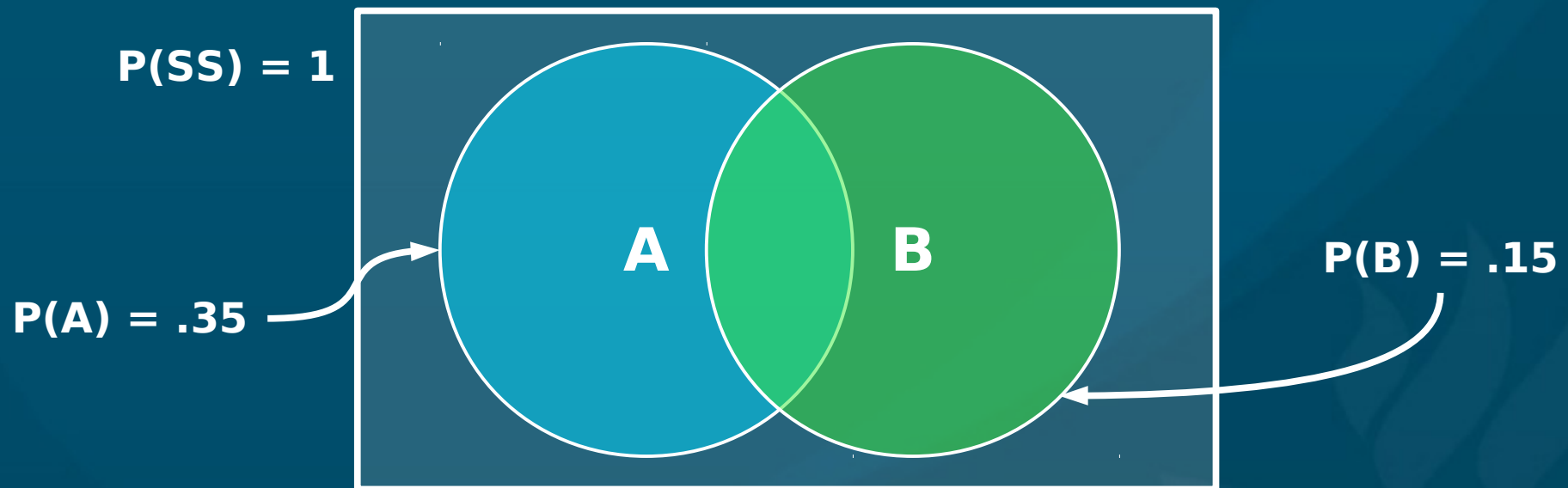
- A = "clicks on ad"
- B = "buys product"

Conditional probability

- P(A|B): probability of A given B
  - "Narrows" the sample space to B
- P(buy) might be pretty small
  - Especially if nobody's heard of us
- P(buy | likes ad) could be much bigger
  - If the ad is effective: conversion rate

- Bayes' Theorem: P(A | B) = P(A ∩ B) / P(B)

Bayes' Theorem: example

- Focus group marketing study:
  - A = likes our ad
  - B = buys our product

- 60% of the focus group likes our ad: P(?) = .60
- Of those who like our ad, 10% buy our product (i.e., 10% conversion rate): P(?) = .10
- ⇒ What fraction of the focus group likes our ad and buys our product?
  - P(B | A) = P(A ∩ B) / P(A)
    - ?   =   ?   /   ?
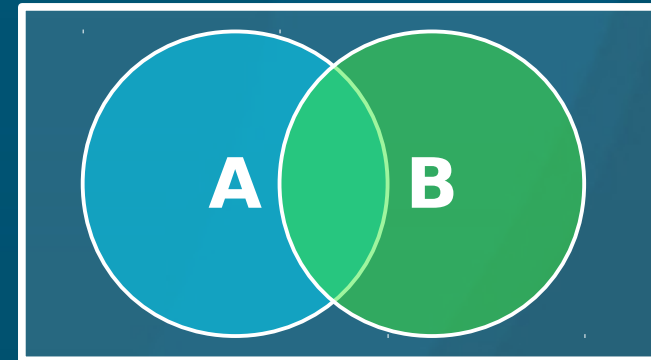
Statistical independence

- Two events A and B are independent when:
  - $P(A|B) = P(A)$, or equivalently, $P(B|A) = P(B)$
  - One event being true does not change the probability of the other event happening
- e.g., A = wears socks, B = has blue eyes
  - $P(\text{wearing socks})$ is the same regardless of whether the person has blue eyes
- e.g., A = first person buys our product, B = next (random) person buys our product
  - Assumes customers don't talk to each other
- Would these be independent?
  - A = likes our ad, B = buys our product

Indep. vs. mutual exclusivity

- A = likes our ad, B = buys our product
- But what if someone says:
  - "Just because someone doesn't like our ad, doesn't mean that they can't still buy our product – just because event A is true doesn't mean that event B is impossible."
- Is this a statement about independence or mutual exclusivity?

Independence and Bayes' rule

- Recall Bayes: $P(A|B) = P(A \cap B) / P(B)$
- Rewrite it as: $P(A \cap B) = P(A|B)\,P(B)$
- If we also know that A and B are independent, then $P(A|B) = P(A)$, so Bayes' rule simplifies to:
  - $P(A \cap B) = P(A)\,P(B)$
- P(both customers buy) = P(cust1 buys) P(cust2 buys)

buy
15%

no buy
85%

buy
15%

no buy
85%

buy
15%

no buy
85%

Cust1	
∩	Cust2

Conditional prob example

- Shipments of three products, from each of two countries
  - Variables: product, country
- Pivot table (joint freq distrib):

	Turbo	Intake	Flywh	Total
Japan	200	500	300	1000
Mexico	150	800	550	1500
Total	350	1300	850	2500

- What fraction of the shipments are turbos?
- How many Japanese intake manifolds?
- What fraction of flywheels come from Mexico?
- Are shipments of products indep of country?

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Experimental Process

- Research question (RQ): topic of interest
- Population of interest and unit of observation
  - Per person? Per store? Per year?
- How to collect data: survey? Observer?
  - Sampling: how to recruit participants?
  - Survey questions
- Pre-test survey on a small set
  - Refine survey as needed
- Collect full dataset (required sample size?)
- Analyse: understand the structure in the data
- Interpret and present results

Research ethics

National Council on Ethics in Human Research

Conseil national d'éthique en recherche chez l'humain

- Three core principles:
  - Respect for Persons
  - Concern for Welfare
  - Justice
- Affects:
  - How we recruit participants
  - Disclosure of purpose and risks/benefits
  - Voluntary, informed, ongoing consent
  - Privacy + confidentiality, handling of data
  - Conflicts of interest

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Ethical abuses in research

- Tuskegee syphilis study (1932-72)
  - Observe natural progression
  - 400 poor, black, men w/syphilis
  - Not told they had it or treated
  - "Health checkups" actually placebo
  - Not given penicillin even after it was proved effective in 1940s
- Baylor "Texas Vampires" (1998)
  - 70 relatives in NL with Wolff-Parkinson-White
  - Rushed, pressured consent process
  - No follow-up, disclosure of results

What requires REB approval?

- What is research?
  - "An undertaking intended to extend knowledge through a disciplined inquiry or systematic investigation."
- Not research: Quality Assurance
  - Assessing or improving performance: job satisfaction, safety compliance, etc.
  - Mandated by the job or training
- Not research: Creative Practise
  - Critique of art, analysis of creative process,...
  - Work involving human subjects (e.g., focus group) does count as research

What is exempt from REB?

- Existing data in public domain
  - e.g., StatCan, Forbes, CBC
  - Steward of the data grants legal access
    - Check terms and conditions / license
  - No reasonable expectation of privacy
- Studies internal to an organization
  - QA, performance review, assessment
  - e.g., does age of company-provided computer correlate with employee satisfaction?
  - If internal data is later used for broader research, that would require REB approval

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What is exempt from REB?

- **Observation** in public places
  - Mall, sports arena, public bus, etc.
  - No reasonable expectation of privacy
  - No staged intervention or direct interaction
  - No personally identifiable info in results
- **Secondary** use of anonymised data
  - Originally gathered for non-research use
    - Patient or school records, online polls
  - No way to identify individuals from data

Example: REB exempt?

- A team of political scientists have observed that the difference between the exit polls (how people said they voted) and the official vote count (how the vote turned out) during a recent election was far greater than would normally be considered statistically possible.

- They have collected exit polling data from a large representative sample of voting locations across the country and have interviewed electoral staff from these stations. The interview transcripts show a pattern of irregularities in the collection of voting results from the computers and the treatment of ballot boxes holding paper voting slips.

- The report of their findings promises to be very critical of electoral policy and of the current administration of the country.

Voting study example

- **Answer**: No, most likely not REB exempt
- **Exit poll** data and actual **vote counts** are okay:
  - **Secondary** use of **anonymous** data
- **Interviews** with electoral staff count as **research** involving human subjects
  - Need **informed consent** from interviewees
  - Disclose **risks** & **benefits**
  - Allow **anonymity**

Principles: Respect

- Autonomy
  - Voluntary participation
  - Opportunity to ask questions
  - Ability to opt-out at any time
- Informed consent
- Honesty (any deception requires debriefing)
- Privacy & confidentiality
  - Securing personally identifiable data
- Fair recruitment (no unneeded selection bias)
- Follow up (what did we do with their data?)

Principles: Concern for Welfare

- **Risks** vs. **benefits**
  - **Informed** consent
  - Risks include social **stigmatization**, impact on **employment**, right to **privacy**
  - Benefits do not mean cash compensation, but greater **understanding** of themselves or some **issue**, or **treatment**, aid, etc.
- Will our research **benefit** anyone, or is it purely for the sake of **knowledge**?
- **Vulnerable** populations
  - Children, seniors, mentally ill, poor, …
- View them as **people**, not just **data**

Principles: Justice

- Inclusion / exclusion:
    - What are our criteria for participants?
    - Are we unfairly discriminating against anyone in the way we recruit participants?
    - Are we excluding anyone who could benefit from the study?
- Any materials presented to the participants:
    - Posters / flyers, emails, wording of questionnaire, consent form
    - If the participant sees it, the REB needs to see it!

Example: what are the risks?

- A sociological researcher wants to use a snowball sampling technique to interview workers in a telephone call centre about their working conditions.

- This technique involves asking current participants in the study (recruited from advertisements) to identify others who may be interested in doing the study.

- It is well known that the employer is resistant to all outsiders who may alter the call centre's practices.

Obtaining consent

- Must be voluntary:
    - No coercion, pressure, undue incentive
    - No penalty for opting out
- Must be informed:
    - Disclose purpose, risks, benefits
    - Give contact info and opportunity for Q&A
    - Participant must have capacity to consent
- Must be ongoing:
    - If new info arises that may impact whether the individual wishes to continue, you must inform them and ask whether they wish to continue
    - Consent may be withdrawn at any time

REB criteria

- Inclusion / exclusion criteria
- Risks & Benefits
- Privacy & Confidentiality
  - Data Management
- Recruitment (Sampling) Procedures
- Consent Procedures
  - Withdrawal of consent / participation
- Materials: flyers, scripts, surveys
- Dissemination / publication of results

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For more details

- Handy links, templates from NS Ag Coll
  - Colin Robson's research links
- The full rules are in the TCPS-2:
  - Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans
- TCPS-2 CORE: Course on Research Ethics
  - HTML and Flash-based, go at your own pace
  - Anyone can register (use your @mytwu.ca)
  - Cool case studies, and quizzes to test self
  - PDF certificate upon completion
- If the REB rejects your application, you may be required to complete the CORE tutorial

TODO

- HW2 (ch2-3): due online, this Thu 26Jan
  - Text document: well-formatted, complete English sentences, with figures
  - Supplementary Excel file, also well-formatted
- Proposal meetings this two weeks 23Jan - 3Feb
  - Submit proposal ≥24hrs before meeting
- Dataset description due in 2 weeks: 7Feb
  - If using existing data, need to have it!
  - If gather new data, have everything for your REB application: sampling strategy, recruiting script, full questionnaire, etc.