This course provides an introduction to the use of decision sciences in health care. In addition to developing a conceptual understanding of medical decision making, the course will develop technical skills in decision analysis including the creation and evaluation of decision trees, the use of sensitivity analysis, and the incorporation of specific patient preferences through the use of utility analysis. The advantages and disadvantages of formal mathematical models for the analysis of clinical conditions will be presented, and examples from the current medical literature will be discussed.

Course Mechanics

Class meets on Mondays and Thursday from 3:00 – 5:00. There is NO CLASS on Monday, October 25.

1.0-credit course; total of 8 sessions (2 hours per session)

Course Director

Cindy Bryce (contact information: bryce99@pitt.edu or 412-692-4826)

Office hours by appointment

Teaching Assistant

Name and contact information: Stanley Kuo (shk26@pitt.edu).

Office hours:

- Mondays and Thursdays (9:00 – 11:00) in Parkvale 320
- Wednesdays (1:30 – 4:00) in Parkvale 311
- Other times by appointment

Course Textbook

Assigned readings are listed in the syllabus for each class. There is no required textbook, but optional readings using the following textbook are provide where relevant:


Course Requirements

Grades for the course are assigned on the basis of homework assignments (45%) and a final project (55%).

There are 3 homework assignments worth 15 points each. Assignments are available on Blackboard. Due dates are listed below and also posted on Blackboard; late assignments will not be accepted. Note: Students are expected to show their work (e.g., formulas, calculations) on all homework assignments. Assignments must be legible. When the steps or details of a solution are not provided (or are not clearly written), the point valuation of the student’s answer is left to the discretion of the instructor.

The final project is worth 55 points and is described below. Late projects will not be accepted.
Final Project (55 points)

The final project is a 4- to 5-page proposal describing a research problem that can be addressed using decision analysis. The proposal should include the following:

- **Question of interest (5 points)** – what research question do you want to answer? (Note that this section is due on Monday, 10/11, though it should also be included in the final proposal.)

- **Background and rationale (10 points)** – describe the significance of the problem, the relevant study population, prior research (yours or others’), and the perspective of your decision analysis (who’s the decision maker?). This section is limited to 1 page (maximum).

- **Rationale for using decision analysis (10 points)** – include a description of the choices, tradeoffs, uncertainties (probabilities), and values (outcomes). What’s the best outcome? What’s the worst outcome?

- **Decision tree (15 points)** – construct a decision tree for your problem/question and fill in the probabilities and values. If you don’t have actual estimates for certain parameters (e.g., probabilities, utilities, values), then describe them in words or notation [e.g., P(death | surgery)].

- **Data sources (5 points)** – what information already exists regarding the probabilities, utilities, and outcomes? (Include references.) Based on these data, explain your rationale for choosing initial estimates (base case analysis) and for determining a plausible range for your sensitivity analyses.

- **Data collection (10 points)** – at least one of the outcomes/values to include in your decision analysis should be quality-adjusted life years (QALYs), and this requires having utilities for relevant health states. Describe those relevant health states. How will you acquire utilities for these health states? Describe and justify your method for collecting/eliciting utilities. [Alternatively, if you are working with health states where “off the shelf” utilities exist, then discuss (1) how they were derived, (2) similarities/differences between the population used to derive those utilities and your patient population, and (3) why these off the shelf values are appropriate for your project.]

Final projects should use Arial 11-point font and 1-inch margins on all sides. Maximum length is 5 pages, including text, trees, any other figures/tables, and references.

Class deadlines – all assignments are due at 5:00 on the specified date (either in class or emailed to the TA).

- **Monday, 10/11** – Homework 1 and topic for final project
- **Monday, 10/18** – Homework 2
- **Thursday, 10/28** – Homework 3
- **Thursday, 11/04** – Final project
Concepts and Topics
1. Introduction to the need for decision analysis and conditions required for a problem to be appropriately addressed by a formal decision analysis
2. Prescriptive versus descriptive analysis of problems
3. Examples of clinical/social problems addressed by decision analysis
4. Basic elements of decision analysis (nodes, branches, probabilities, outcomes)

Required Reading (prior to session)

Optional Reading
- Sox, chapters 1-3

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Concepts and Topics
1. Use of contingency tables to estimate probabilities
2. Review of probability rules
3. Elements of a decision tree (nodes, branches, probabilities, outcomes)
4. Steps for solving a decision tree (averaging out/folding back)

Required Reading (prior to session)
- Choose 1 of the following articles:

Optional Reading
- Sox, chapter 3, 6
### Session 3 10/07  Bayes’ Theorem and diagnostic testing  Bryce

**Concepts and Topics**

1. Common structural errors and pitfalls in building decision trees
2. Using Bayes’ Theorem to compute probabilities for decision trees
3. Special case of diagnostic testing (2x2 contingency tables)
4. Measures of test performance (sensitivity, specificity, PPV, NPV, likelihood ratios)

**Required Reading (prior to session)**


**Optional Reading**

- Sox, chapters 3-5

### Session 4 10/11  Value of information and sensitivity analysis  Roberts

**Concepts and Topics**

1. Receiver Operating Characteristic (ROC) curves
2. Uses of sensitivity analysis
   - Patient subgroups, examining outcomes in different risk sets
   - Testing the model’s robustness to errors in assumptions
   - Providing information on critical values and areas for further research
3. One-way sensitivity analysis, thresholds
4. Two- and three-way sensitivity analyses

**Required Reading (prior to session)**


### Session 5 10/14  Quality of life assessment, part 1: health status measures  Bryce

**Concepts and Topics**

1. Health status and quality of life as patient-centered outcomes
2. Attributes of quality of life instruments
3. Examples of health status measures for assessing quality of life
4. Computing quality-adjusted life-years (or, “What health status measures cannot do”)

**Required Reading (prior to session)**
  Also **CHOOSE 1** of the following articles:

Optional Reading
- Sox, chapters 7-8

Session 6 10/18 Quality of life assessment, part 2: preference-based measures Bryce

**Concepts and Topics**
1. Quality-adjusted life-years
2. Utility theory, preferences, and the value of intermediate states
3. Direct methods of assessment (relative value scale, time trade-off, standard gamble)
4. Indirect methods of assessment (health state classification systems and multi-attribute utility theory)

**Required Reading (prior to session)**

**Optional Reading**
- Sox, chapters 7-8
Session 7  10/21  Psychology of decision making (biases and heuristics)  Farris

Concepts and Topics
1. Translating normative decision analysis to descriptive decision making, pitfalls and problems
2. Descriptive decision making (base rate neglect, heuristics, and limits of primate cognitive architecture)
3. Decision making under uncertainty and time pressure, overview of computational decision making models

Required Reading (prior to session)

Optional Reading

REMINDER: No Class on Monday 10/25

Session 8  10/28  Markov processes  Smith

Concepts and Topics
1. Limitations of static trees/nodes for modeling events that occur over time or repetitively
2. Life expectancy models and survival analysis

Required Reading (prior to session)

Optional Reading

REMINDER: Final Project is due on Thursday 11/04