Industrial Engineering 546 Spring 2017
Economic Decisions in Engineering

Exam 2

Student Information (print neatly)

Name: ________________________________

Purdue email: ___________________________

Directions:

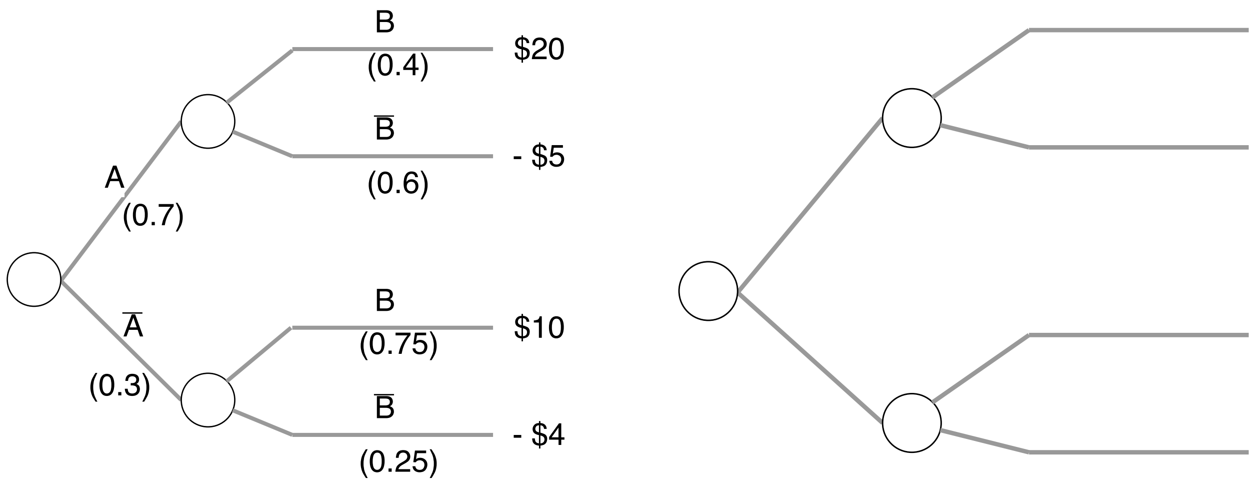
- You have 60 minutes to complete this exam. If you open the test before stated or do not turn it in on time you will lose 20 points.
- This exam is closed book and notes. You will receive a zero for this exam for using books, notes, electronic devices (cell phone, ipad, calculator, laptop, etc.). You will also be reported and appropriate disciplinary action will be taken.
- Your answers must be legible. Circle, underline, or leave sufficient white-space to distinguish your answers from intermediate work. The last page is scratch paper and may be torn out.
- Show all your work.

Grade:

1. [25] ___________________________
2. [25] ___________________________
3. [30] ___________________________
4. [20] ___________________________

Total: ___________________________

Problem 1. [25 points] In this problem you will flip a decision tree.

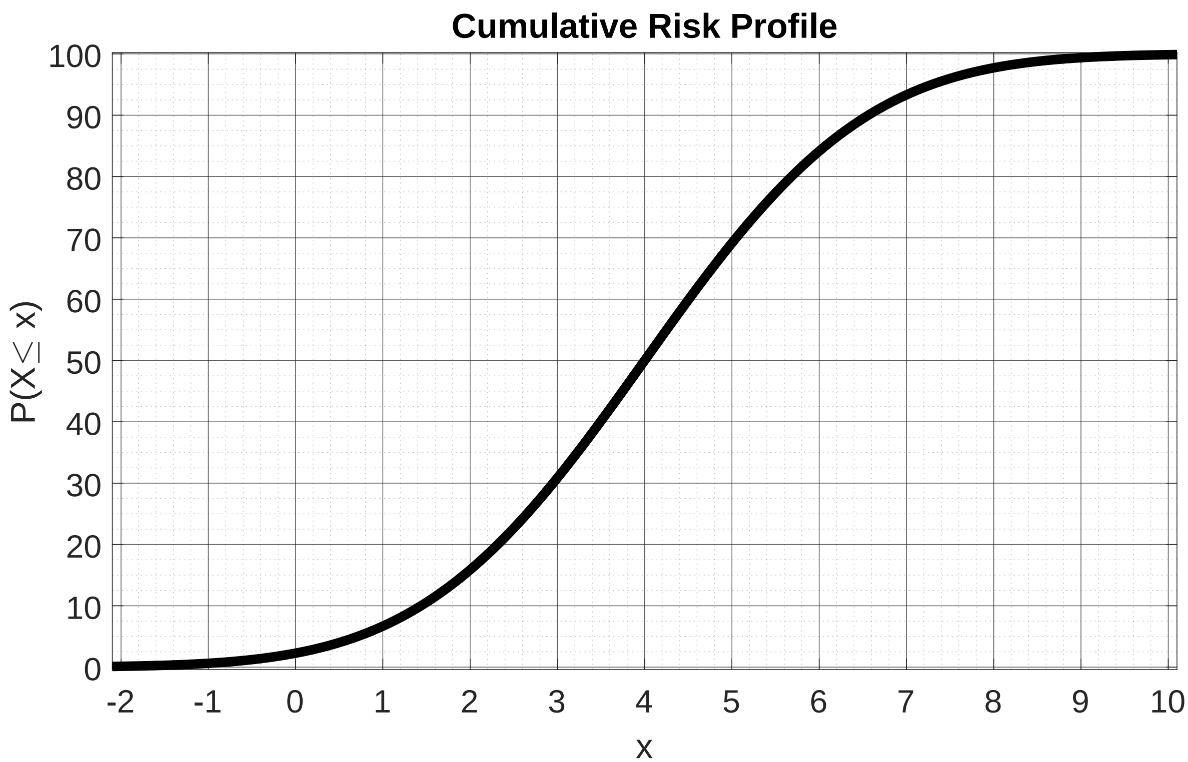


A. Write down the formulas for each of the probabilities in the left tree. (eg "$P(\dots) = 0.92$")

B. Label the outcome branches, final values, and the probability formulas (no #'s) for the tree on the right.

C. Solve for each of the probabilities in the right hand tree using probabilities in the left hand tree. Leave in terms of formulas (eg $P(\dots) = P(\dots)P(\dots) - \dots$). Don't plug-in values.

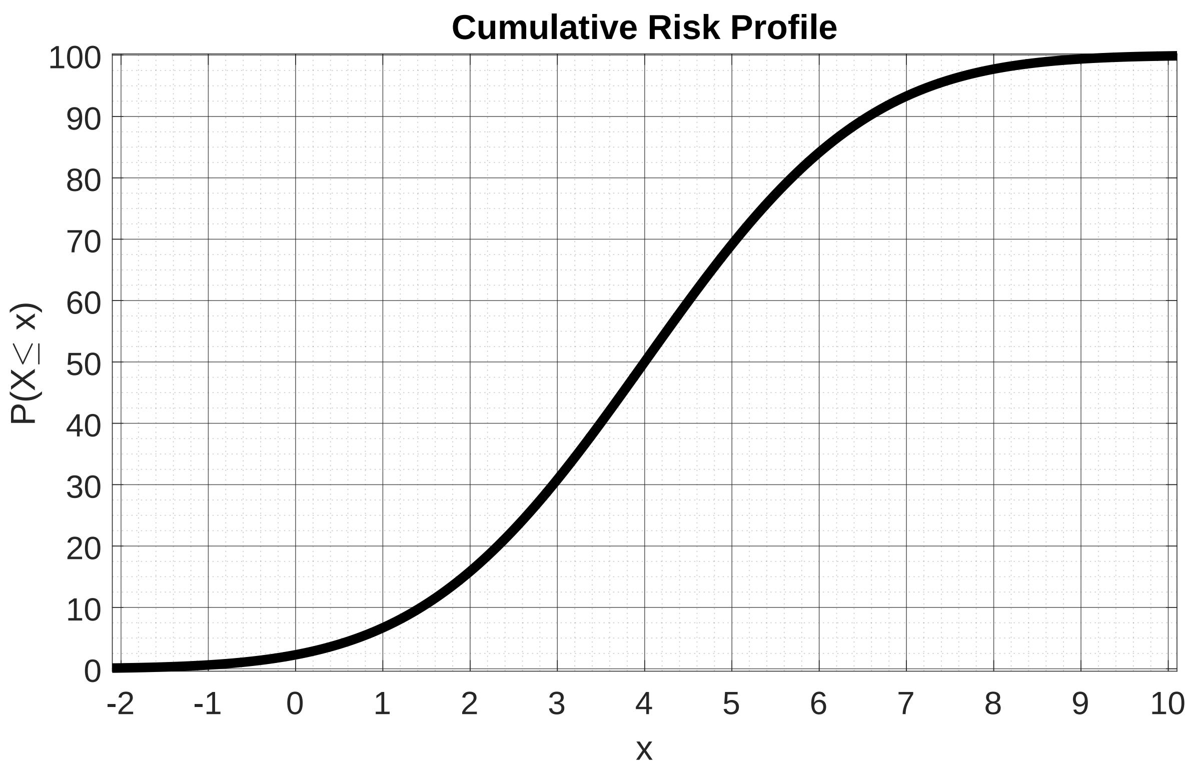
Problem 2. [25 points] You will approximate the following cumulative risk profile using discrete approximations.



For the following, round x-coordinates to the nearest half (eg, $\{\ldots, 4,\ 4.5,\ 5,\ 5.5,\ 6, \ldots\}$).

A. Find the Pearson-Tukey approximation Q_1. Write down the distribution. Also plot the corresponding cumulative risk profile of Q_1 on the graph above.

(the probabilities are shown on the last page)

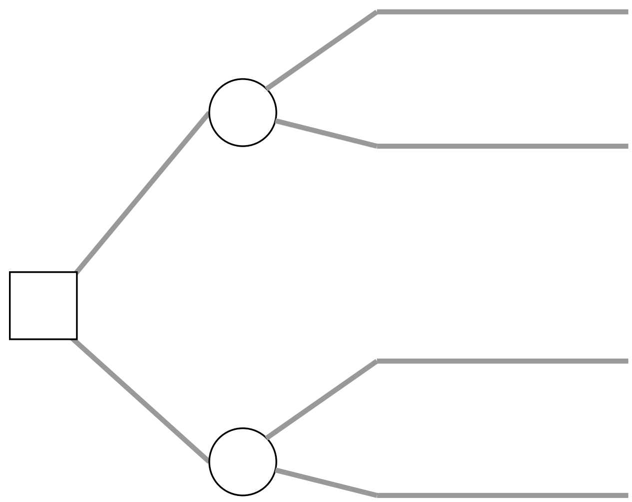


B. Find an approximation Q_2 using five equal-sized brackets. Write down the distribution. Also plot the corresponding cumulative risk profile of Q_2 on the graph above.

C. Visually, which approximation appears more accurate?

Problem 3. [30 points] Prof. Quinn says he thinks the New England Patriots have a 75% chance of beating the Atlanta Falcons when they rematch in the 2017 season. Label the following trees appropriately.

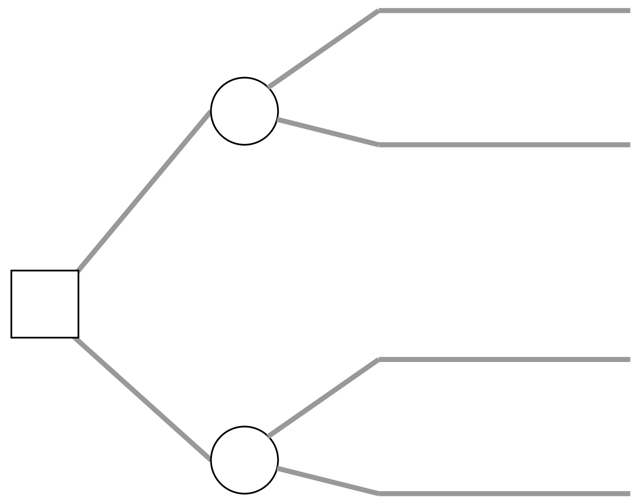
A. You want to test if that is actually what he believes. Set up a symmetric lottery to assess his belief, starting with 75%. The magnitudes of the dollar amounts in each gamble should add to $100.



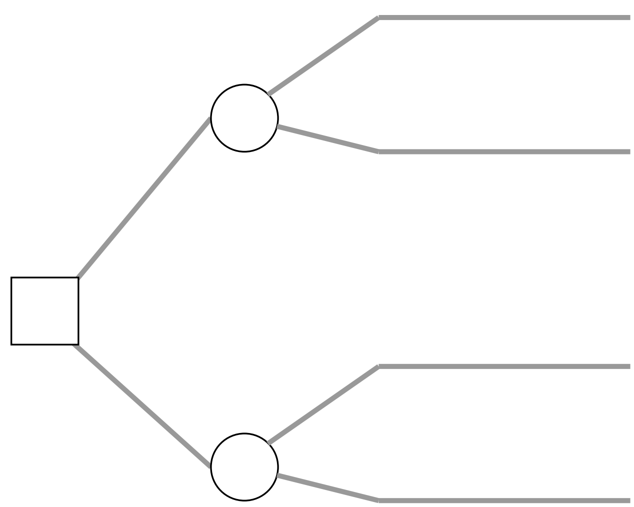
B. Suppose you iterate through a few trees until Prof. Quinn says he is indifferent. Briefly explain the logic for how his indifference to the revised lottery lets you infer his belief. Let $\$X$ and $-\$Y$ denote values in the top revised gamble.

Now you want to assess Prof. Quinn's belief for the the Patriot's final score. Treat the score as a continuous variable. Thus, you will try to infer his (implicit) continuous risk profile $P(X \leq x)$ for the score.

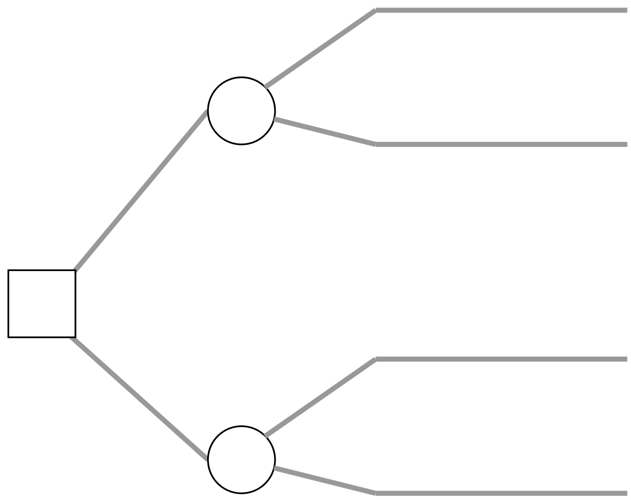
C. Consider the case that you partition the x-axis. Set up an initial symmetric lottery for the x-coordinate 31 with probability 0.75.



D. Suppose he says he prefers the bottom gamble. What does that mean about the probability 0.75 for x-value of 31? Construct a new lottery in response to his preference. (the specific values don't matter, just how they differ from the lottery above)



E. Consider the case that you partition the y-axis. Suppose you use the same initial lottery as on the previous page (with probability 0.75 for x-coordinate 31), and Prof. Quinn says he prefers the top gamble. Construct a new lottery in response to his preference. (the specific values don't matter, just how they differ from the lottery above)



Problem 4. [20 points]

A. Consider two events, A and B. Express the following relationships using probability formulas.

   1. A and B are independent

   2. A and B are mutually exclusive

B. Your IE 546 prof tells you that a 1973 study of UC Berkeley graduate admissions found that men had a 44% acceptance rate while women had a 35% acceptance rate. Yet if you look at individual departments, women had the same or higher admissions in many of the departments. Is this possible? Briefly explain why.

C. Briefly explain the main pro and con of using decomposition to assess beliefs for complex events.

D. Label which example corresponds to which of the following biases (one each): anchoring, gambler's fallacy, retrievability, prior blindness (aka base-rate fallacy).

   1. "what are the odds of winning the lottery?" Having won last week, you reply "pretty good!"
   2. You get an email with the name of your assigned teammate for an ECE senior design class. You haven't seen that name before and can't distinguish gender from it. You guess there's a 50/50 chance your teammate is male.
   3. You are at a roulette table and black has come up several times in a row. You decide to go all in for red.
   4. To decide how much you should study for this exam, you first thought about how much you studied last exam and then decided to study some more. Now, with 5 min left in the test, you realize it wasn't enough.

Scratch

- Pearson-Tukey approximation

$$Q(x) = \begin{cases} .185 & \text{if } x = x_{0.05} \\ .63 & \text{if } x = x_{0.5} \\ .185 & \text{if } x = x_{0.95} \\ 0 & \text{o/w} \end{cases}$$