BM20A8800 Discrete Models and Methods 3op
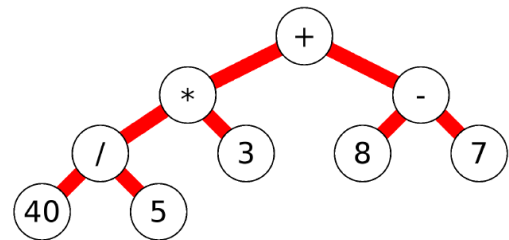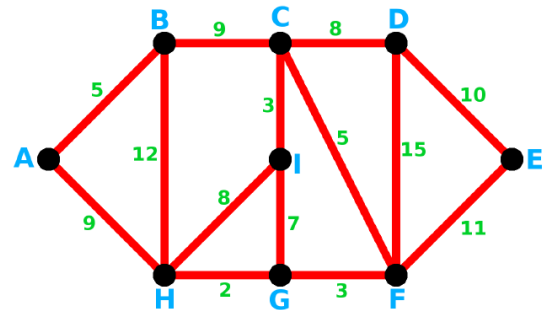
Exercise 7 / Week 9

1. a) Draw an expression tree for $a - \dfrac{b}{(c+d)\cdot f}$

b) Interpret the expression tree on the right. Which arithmetic expression does this tree represent, and what number do we get if we calculate the expression?

2. Define the minimal spanning tree for the weighted graph shown on the right. Use Prim's algorithm in matrix form.

3. Define the minimal spanning tree for the weighted graph shown below. Use Prim's algorithm in matrix form.
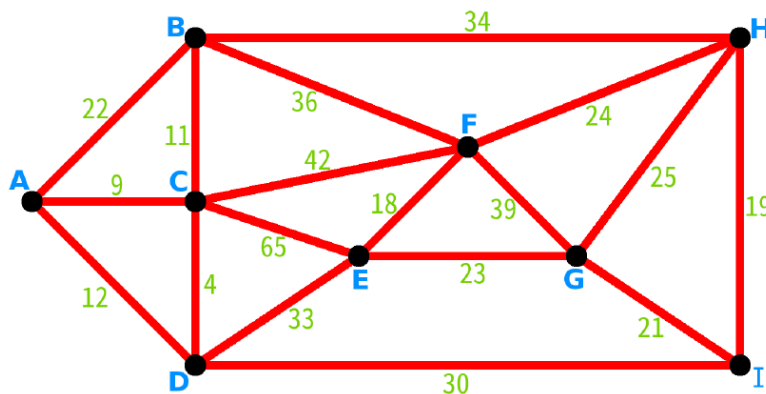
4. An investor is thinking whether he/she should make an investment on a new smartphone application. If the investor says "No" and invests the money in an ETF fund, he/she estimates that this will yield a profit of 40 k€. For the application, he/she sees two options with 50/50 odds: either the app will be moderately popular (10 k€ profit) or really popular (60 k€ profit). There's one catch: if the application becomes really popular, the investors can think of including micropayments to the application. This change could either bring huge profits (500 k€) with a probability of 30 % but also it could infuriate the users, collapse the user pool and make the whole 100 k€ investment obsolete.
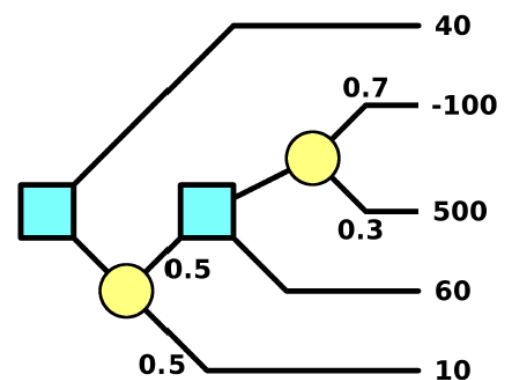
On the right there's an illustration of the decision tree. Analyze what the investor should do based on expected utility hypothesis.

5. The Walrus family owns several pieces of real estate, which they rent to customers and naturally gather profits from this. By following the condition and rent levels of other similar properties in the city, the wise family members have reasoned that they have 3 options for the next time window:

1) Full renovation. This would cost 1.4 million euros, but it would set the apartments in highest quality class at least for the next 10 years. It happens that the government of the country is considering the location of one bureau to this city. If the city would be chosen, this would bring a lot of well-off tenants to the rent market, so there would be a huge demand for quality apartments: in this case the rent prices could be increased and the apartments would produce 2.5 million euros more revenue in a time span of 10 years. If the bureau will not be located in this town ,the additional revenue would be smaller due to lesser demand – only 800k€. The family estimates that the probability of getting the bureau to the city is approximately 40 %.

2) Light renovation of surfaces. This would cost less – only 500 k€, but the revenue would not be increased as much. If the bureau is located in our city, the additional revenue would be one million euros. If the bureau goes to some other city, then the additional revenue will be only 400 k€.

3) Make no renovations – just the mandatory upkeep duties. The money spent on upkeeping is gathered from tenants as index rises, so no investments are needed, but there's no way to get any additional revenue.
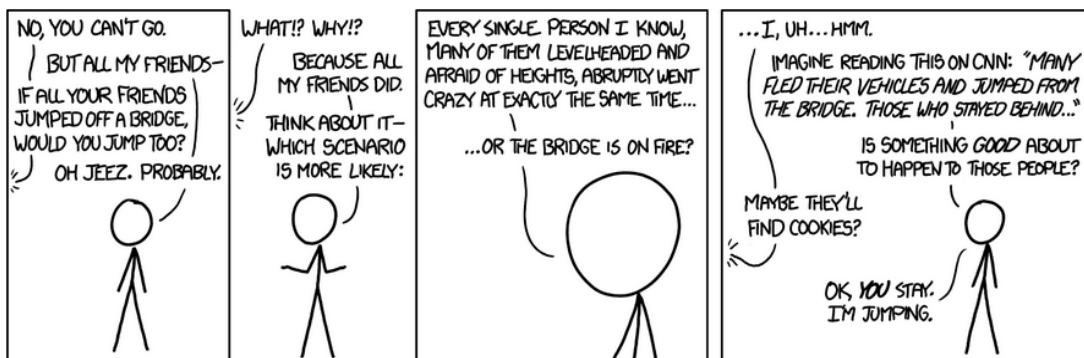
a) Draw a decision tree of the situation.

b) Perform decision analysis based on expected utility hypothesis. Which option would be the wisest?
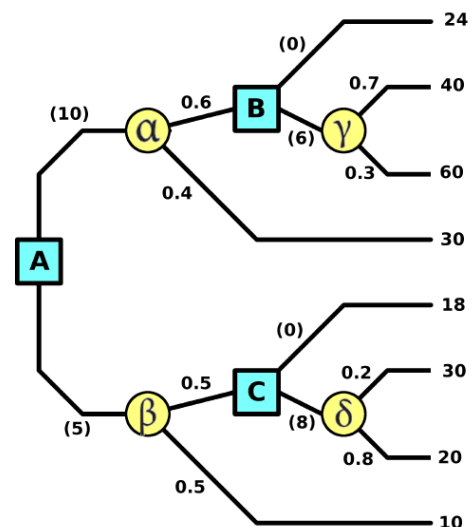
6. On the right you see a decision tree that has been drawn according to option 2: on the right, there are additional revenues, and the costs of each decision have been marked in parentheses over the option edges. Also, now there are several random events instead of just one.

a) Redraw the decision tree according to option 1.

b) Perform decision analysis base on expected utility hypothesis.