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Decision trees — SOLUTIONS

8.1 Running and analysing results

Run the file "practical.R". Can do this using `source("practical.R")`

Required R code is

```
# Net benefit
(net.benefit <- lambda.target * effects - costs)

# Incremental results relative to no treamtent
(incremental.costs <- costs - costs[1])
(incremental.effects <- effects - effects[1])
(incremental.net.benefit <-
    lambda.target * incremental.effects - incremental.costs)

# Incremental cost effectiveness ratios relative to no treatment
(icer <- incremental.costs / incremental.effects)
```

Run the file "practical_probs.R". To ensure the input parameters make sense, look at the means of matrices using the `colMeans()` function and the means of vectors using the `mean()` function

For matrices, CBT has lowest probability of relapse

```
colMeans(p.rel)
```

Antidepressant has the highest probability of recovery

```
colMeans(p.rec)
```

Mean cost of treatment (these are actually constant!)

```
colMeans(c.treat)
```

For vectors, Cost of no recovery

```
mean(c.norec)
```

Cost of relapse

```
mean(c.rel)
```

Cost of recovery

```
mean(c.rec)
```

The cost of no recovery is highest, as patients incur higher hospitalization and therapy costs. QALYs of no recovery

```
mean(q.norec)
```

QALYs of relapse

```
mean(q.rel)
```

QALYs of recovery

```
mean(q.rec)
```

The QALY for recovery is highest, as patients don't suffer a relapse and spend most of remaining 30 years if good mental health.

8.1.1 Summary of cost and effects

Mean QALYs of each treatment over 30 years. Very similar but antidepressants and CBT are higher than no treatment.

```
colMeans(effects)
```

Mean costs CBT is the most expensive while no treatment and antidepressant are similar.

```
colMeans(costs)
```

Calculate the net benefit at a willingess-to-pay of £20,000.

```
net.benefit <- 20000*effects-costs
```

Net benefit is highest for antidepressant, but all options are very close.

```
colMeans(net.benefit)
```

8.2 Using BCEA

If BCEA isn't yet installed you'll have to install BCEA first

```
install.packages("BCEA")
```

Load the package

```
library(BCEA)
```

- Create a `bcea` object for the depression decision tree `e` are the effects, `c` are the costs Set the `ref` reference treatment to be 1 (no treatment) Set the interventions, which is the names of the treatments, to `t.names`

  ```
  depression.bcea <- bcea(e=effects,c=costs,ref=1,interventions=t.names)
  ```

- The `summary()` gives comparisons of CBT and antidepressants to no treatment. wtp is the willingness-to-pay threshold. The detafult to 25000 so set this to 20000 The "EIB" is expected incremental benefit at the `wtp=20000`, the "CEAC" is the probability that the reference of "no treatment" has highest net benefit (most cost-effective), and the ICER is the incremental cost-effectiveness ratio.
  We can see that EIB is negative for no treatment relative to both CBT and antidepresants, so the latter two are favoured The CEAC is less than 0.5 so there is a higher probability that CBT and antidepressant are most cost-effective The ICER is less than £20,000 for both CBT and antidepressant so both should be considered cost-effective

  ```
  summary(depression.bcea, wtp=20000)
  ```

- Now comparing CBT to antidepressant Use the `bcea()` function but with `ref=2`, so that CBT is the reference treatment. All other inputs remain the same

```
depression.refCBT.bcea <- bcea(e=effects,c=costs,ref=2,interventions=t.names)
```

The final matrix of EIB and CEAC are of interest. The first row are comparisons with no treatment which suggest CBT is more cost-effective as EIB is positive, CEAC>0.50. The ICER isn't useful for interpretation. The second row tells us that CBT has lower incremental net benefits (EIB is negative) and that the probability that CBT is more cost-effective than antidepressants is less than 50% (CEAC<0.50)

```
summary(depression.refCBT.bcea, wtp=20000)
```

- Multiple treatment comparison For multiple treatment comparison pass the output of `bcea()` to `multi.ce()` This may take a moment

```
depression.multi.ce <- multi.ce(depression.bcea)
```

Now generate the probability that each treatment has the highest net benefit at a range of willingness-to-pay thresholds. These are the cost-effectiveness acceptability curves (CEAC). At £20,000, antidepressants have the highest probability of having highest net benefit (being most cost-effective).

```
ceac.plot(depression.multi.ce,
          pos = c(1, 0.5))
```