

Exer 12.1

[S2008/S2008-rv3]

Two basic operations that you need to perform on probability models are these:

percentile Given a value, what is the probability (according to the model) of the outcome from one trial being that value or less?

quantile Given a probability, what is the value whose percentile is that probability?

To illustrate by example, suppose that you are dealing with a probability model for an IQ test score that is a normal distribution with these parameters: mean = 100 and standard deviation = 15.

Percentile question: What is the percentile that corresponds to a test score of 120? Answer: 0.91 or, in other words, the 91st percentile.

```
> pnorm(120, mean=100, sd=15)
[1] 0.9087888
```

Quantile question: What score will 95% of scores be less than or equal to? Answer: a score of 125.

```
> qnorm(0.95, mean=100, sd=15)
[1] 124.6728
```

- TRUE or FALSE [\[Exer 12.1-1\]](#) The output of a percentile question will always be a probability, that is, a number between 0 and 1.
- TRUE or FALSE [\[Exer 12.1-2\]](#) The output of a quantile question will always be a value, that is, something in the same units as the random variable.

Sometimes to answer more complicated questions, you need first to answer one or more percentile or quantile questions.

Answer the following questions, using the normal probability model with the parameters given above:

- What's the test score that almost everybody, say, 99% of people, will do better than? Which kind of calculation is this: percentile quantile [\[Exer 12.1-3\]](#)? What is the answer? 55 65 75 95 115 125 135 [\[Exer 12.1-4\]](#)
- To calculate a coverage interval on a probability model, you need to calculate two quantities: one for the left end of the interval and one for the right. Which type of calculation are these probabilities from: percentile quantile [\[Exer 12.1-5\]](#).

- Calculate a 50% coverage interval on the test scores, that is the range from the 0.25 quantile to the 0.75 quantile:

Left end of interval: 80 85 90 95 100 105 110 115 120 Exer 12.1-6

Right end of interval: 80 85 90 95 100 105 110 115 120 Exer 12.1-7

- Calculate an 80% coverage interval, that is the range from the 0.10 to the 0.90 quantile:

Left end of interval: 52 69 73 81 85 89 Exer 12.1-8

Right end of interval: 117 119 123 128 136 Exer 12.1-9

- To calculate the probability of an outcome falling in a given range, you need to do two percentile calculations, one for each end of the range. Then you subtract the two different probabilities. What is the probability of a test score falling between 100 and 120? 0.25 0.37 0.41 0.48 0.52 0.61 0.73 Exer 12.1-10