

# Solutions to exercises

Listed below are the solutions to the exercises.

All solutions are computed using RStudio, though **you should only do the exercises in RStudio if stated in the list of exercises**. This may result in slight differences in numerical answers, which is due to rounding errors.

The solutions may often be computed in different ways and when two solutions are given it does not necessarily mean that more solutions does not exist. However, when two solutions are given we encourage you to think about why these two solutions are equivalent.

```
library(mosaic)
```

## Module 1.2

4.3:

a)

```
a <- 210/885  
a
```

```
## [1] 0.2372881
```

b.i)

```
b <- 50/210  
b
```

```
## [1] 0.2380952
```

b.ii)

```
95/675
```

```
## [1] 0.1407407
```

c.i)

```
50/885
```

```
## [1] 0.05649718
```

c.ii)

```
a * b
```

```
## [1] 0.05649718
```

d)

```
yes <- 50/885
no <- 580/885
yes + no
```

```
## [1] 0.7118644
```

4.5:

a)

The probability distribution is not uniform (all events have the same probability of occurring). Moreover, the events does not occur with equal probability.

b)

```
0*0.85 + 1*0.13 + 2*0.01 + 3*0.01
```

```
## [1] 0.18
```

4.11:

Define vector of central probabilities

```
cprob <- c(0.50, 0.90, 0.95, 0.99)
```

Left tail percentiles

```
lprob <- (1 - cprob)/2
lprob
```

```
## [1] 0.250 0.050 0.025 0.005
```

Right tail percentiles

```
rprob <- 1 - lprob
rprob
```

```
## [1] 0.750 0.950 0.975 0.995
```

z-values for a)-d) in one go without graphics

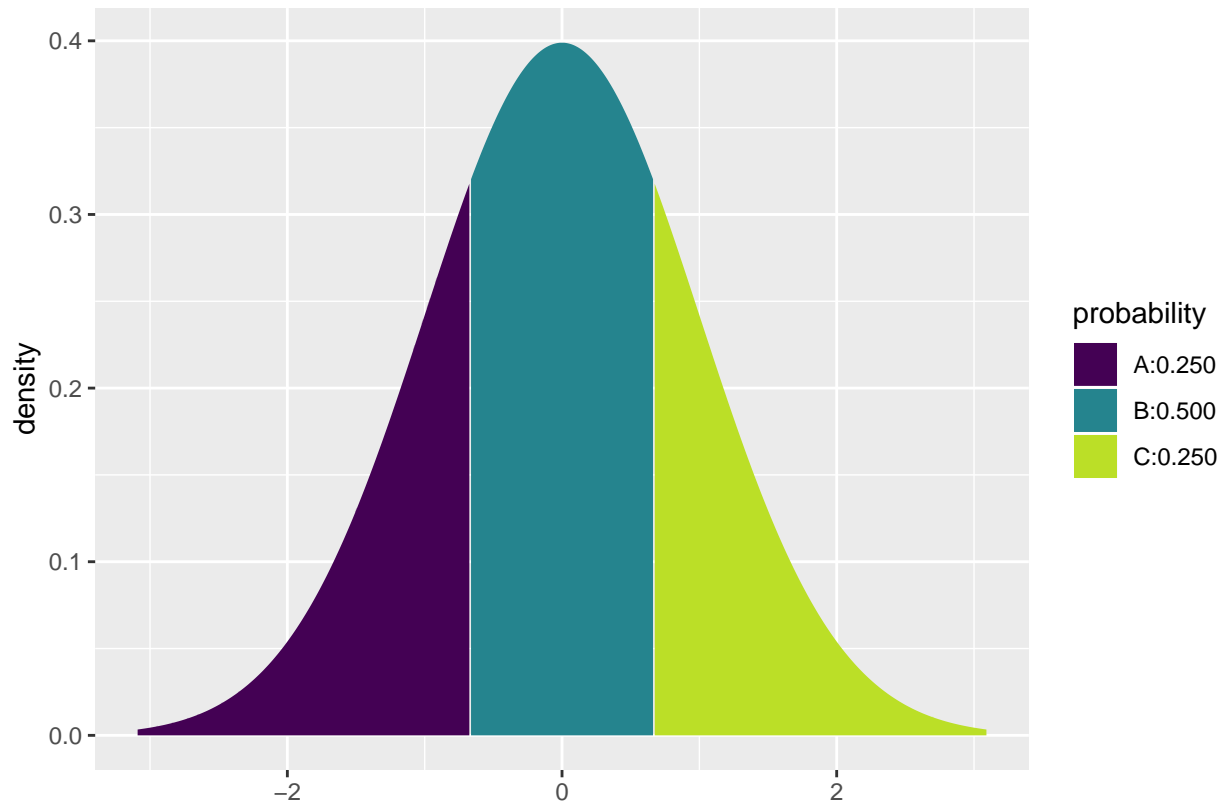
```
qdist("norm", rprob, mean = 0, sd = 1, plot = FALSE)
```

```
## [1] 0.6744898 1.6448536 1.9599640 2.5758293
```

**Graphical solutions:**

a)

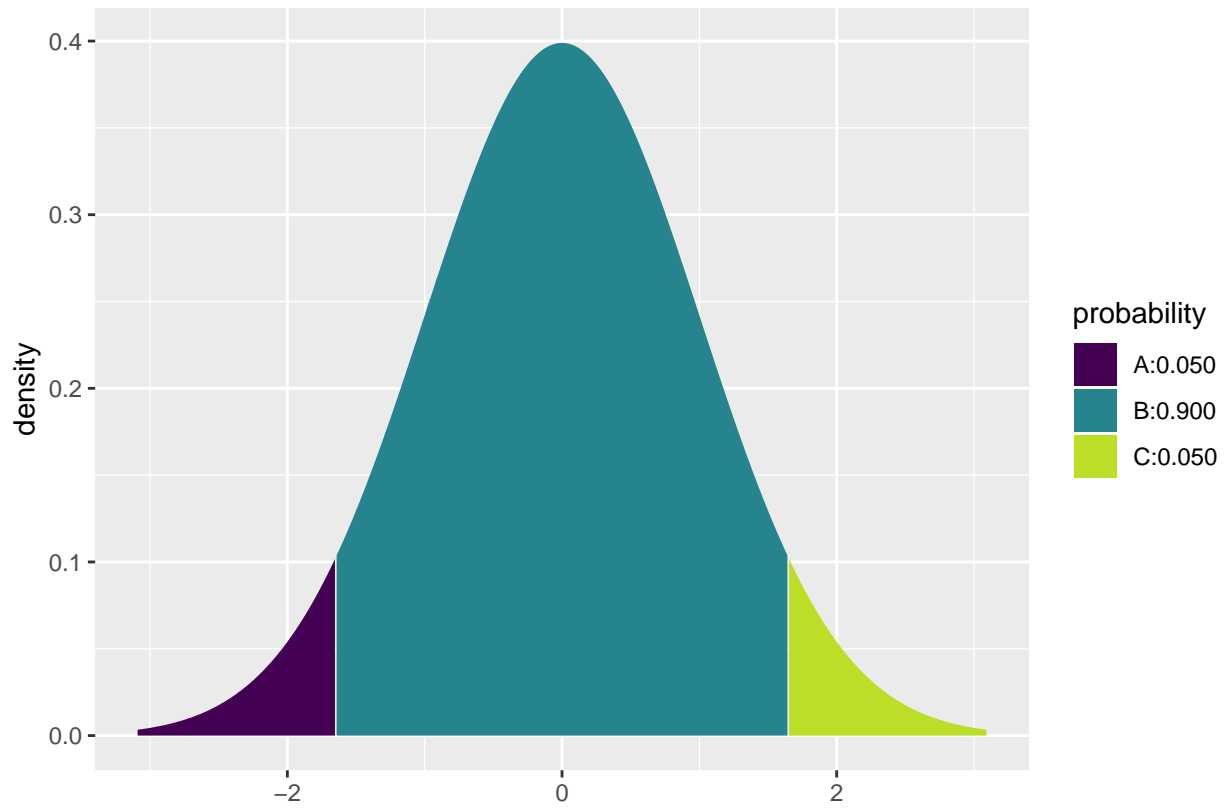
```
qdist("norm", c(lprob[1], rprob[1]), mean = 0, sd = 1)
```



```
## [1] -0.6744898 0.6744898
```

b)

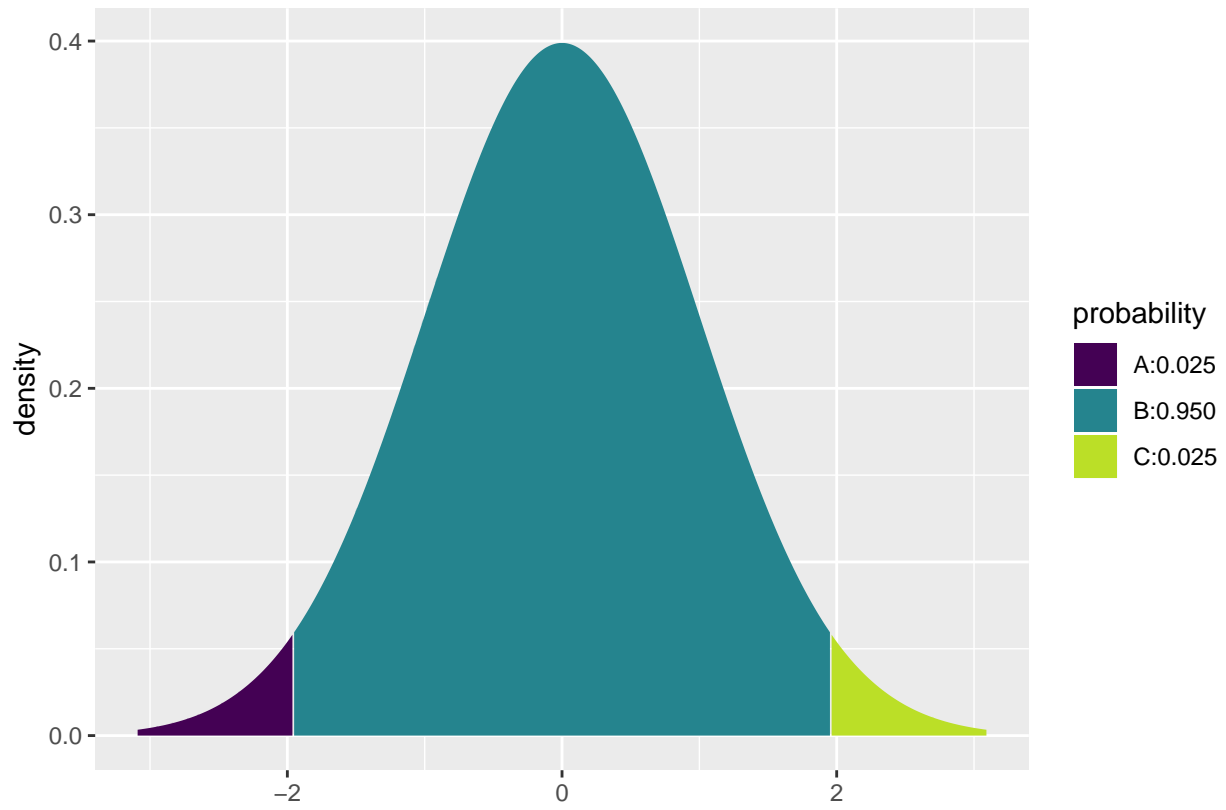
```
qdist("norm", c(lprob[2], rprob[2]), mean = 0, sd = 1)
```



```
## [1] -1.644854  1.644854
```

c)

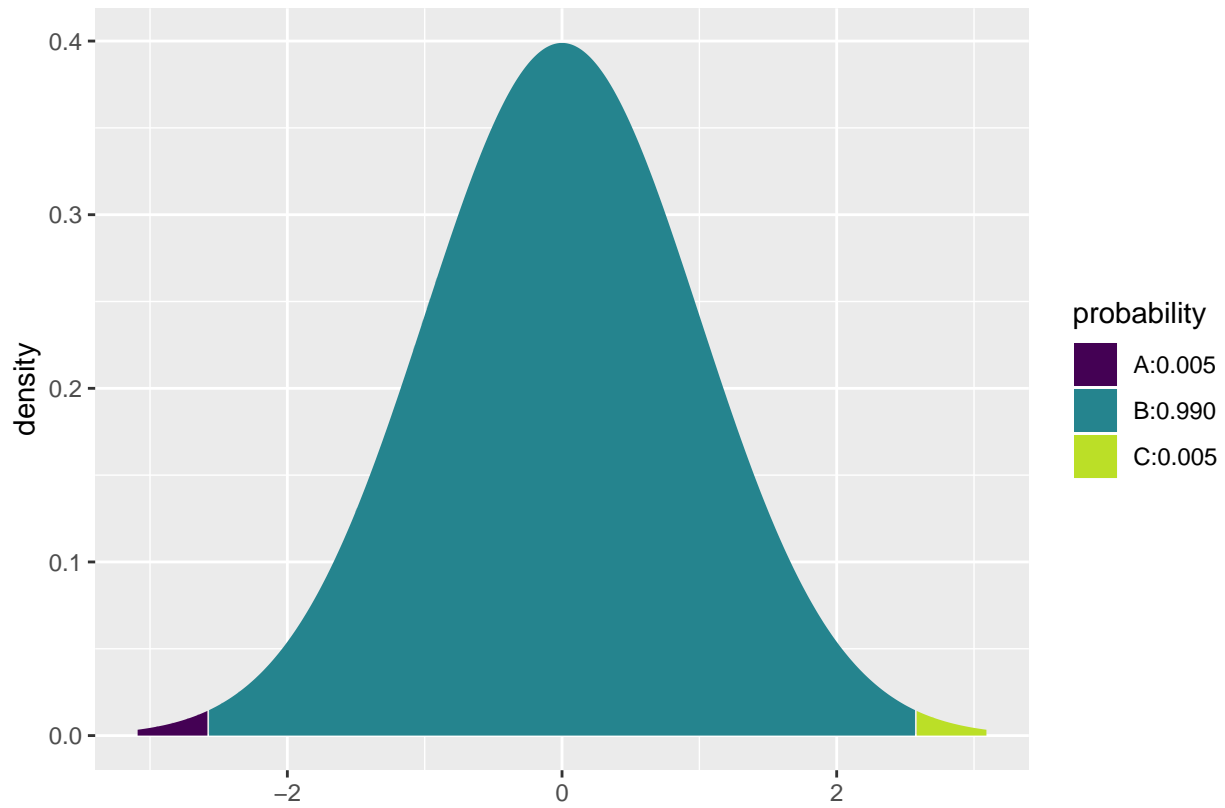
```
qdist("norm", c(lprob[3], rprob[3]), mean = 0, sd = 1)
```



```
## [1] -1.959964 1.959964
```

d)

```
qdist("norm", c(lprob[4], rprob[4]), mean = 0, sd = 1)
```



```
## [1] -2.575829 2.575829
```

4.15:

a)

```
a <- 1 - pdist("norm", 2.1, mean = 0, sd = 1, plot = FALSE)
a
```

```
## [1] 0.01786442
```

b)

Option 1:

```
b <- a
b
```

```
## [1] 0.01786442
```

Option 2:

```
b <- pdist("norm", -2.1, mean = 0, sd = 1, plot = FALSE)
b
```

```
## [1] 0.01786442
```

c)

```
1 - (a + b)
```

```
## [1] 0.9642712
```

4.33:

a)

Option 1:

```
pdist("norm", 95, mean = 100, sd = 15, plot = FALSE)
```

```
## [1] 0.3694413
```

Option 2:

```
pdist("norm", (95 - 100) / 15, mean = 0, sd = 1, plot = FALSE)
```

```
## [1] 0.3694413
```

b)

By CLT, approximately normal with mean 100 and standard deviation  $15/\sqrt{36}$  (which is called the standard error).

```
se <- 15/sqrt(36)
```

Option 1:

```
pdist("norm", 95, mean = 100, sd = se, plot = FALSE)
```

```
## [1] 0.02275013
```

Option 2:

```
pdist("norm", (95 - 100) / se, mean = 0, sd = 1, plot = FALSE)
```

```
## [1] 0.02275013
```

c)

It is **not** unusual to see a PDI of 95. This corresponds to a z-score of  $(95-100)/15 = -0.33$ , which is not extreme at all.

It **is** unusual to see a mean PDI of 95 for 36 infants. This corresponds to a z-score of  $(95-100)/(15/6) = -2$ . The probability of getting such a low z-score or lower is only 0.0227501.

d) Population distribution (black) and distribution of sample mean (red):

```
se25<-15/sqrt(25)
gf_dist("norm", mean = 100, sd = 15) %>%
  gf_dist("norm", mean = 100, sd = se25, color = "red")
```

