Practical 2

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Using the `gamlss.demo` to plot distributions

- Use the package `gamlss.demo` to plot distributions. First download the package `gamlss.demo`.

```
library(gamlss.demo)
gamlss.demo()
```

```
<Tcl>
```

Investigate how the following distributions change with their parameters:

- Continuous distributions
  1. Power exponential distribution `PE` for $-\infty < y < \infty$
  2. Gamma distribution `GA` for $0 < y < \infty$
  3. Beta distribution `BE` for $0 < y < 1$
- Discrete distributions
  1. Negative binomial type I `NBI` for $y = 0, 1, 2, 3, ...$
  2. Beta binomial `BB` for $y = 0, 1, 2, 3, ..., n$
- Mixed distributions
  1. Zero adjusted gamma `ZAGA` for $0 \leq y < \infty$
  2. Beta inflated `BEINF` for $0 \leq y \leq 1$

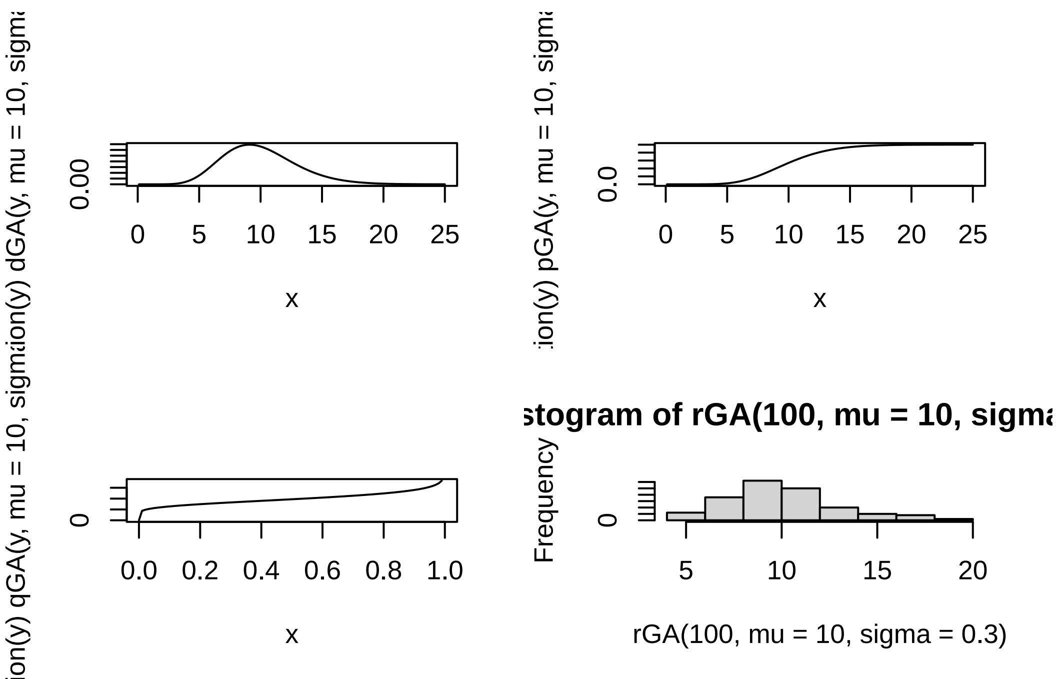
Plotting different distributions

The package **gamlss.dist** (which is downloaded automatically with **gamlss** contains many distributions. Typing

```
?gamlss.family
```

will show all the available distributions in the **gamlss** packages. You can also explore the shape and other properties of the distributions. For example the following code will produce the pdf, cdf, inverse cdf and a histogram of a random sample generated from a gamma distribution:

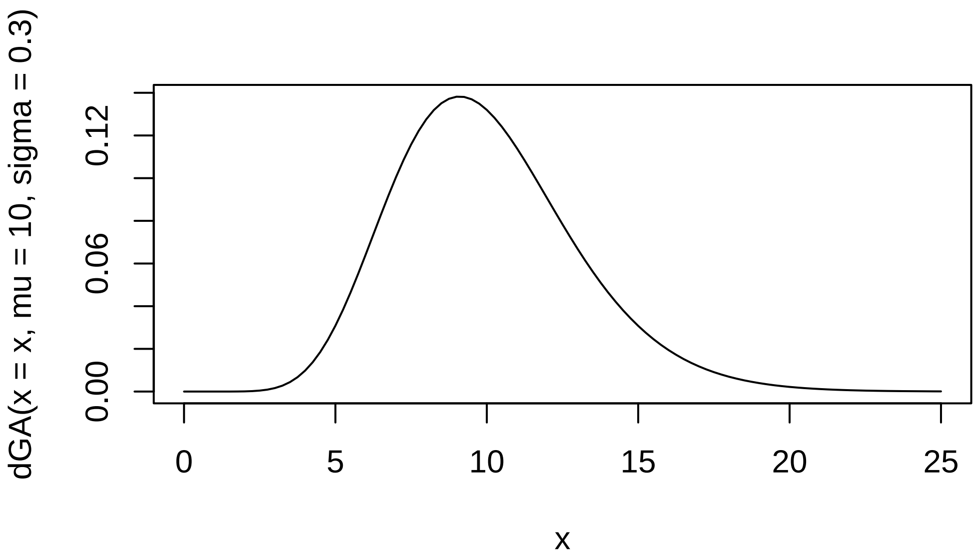
```
PPP <- par(mfrow=c(2,2))
plot(function(y) dGA(y, mu=10 ,sigma=0.3),0.1, 25) # pdf
plot(function(y) pGA(y, mu=10 ,sigma=0.3), 0.1, 25) #cdf
plot(function(y) qGA(y, mu=10 ,sigma=0.3), 0, 1) # inverse cdf
hist(rGA(100,mu=10,sigma=.3)) # randomly generated values
```




```
par(PPP)
```

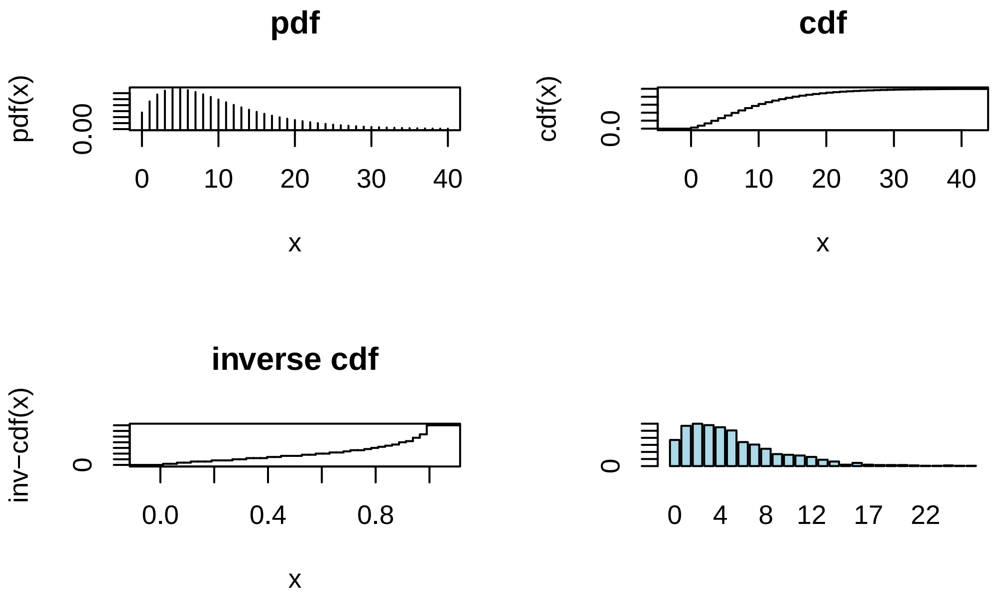
Note that the first three plots above can also be produced by using the function `curve()`, for example

```r
curve(dGA(x=x, mu=10, sigma=.3),0, 25)
```



To explore discrete distributions use:

```r
PPP <- par(mfrow=c(2,2))
plot(function(y) dNBI(y, mu = 10, sigma =0.5 ), from=0, to=40,
     n=40+1, type="h", main="pdf", ylab="pdf(x)")
cdf <- stepfun(0:39, c(0, pNBI(0:39, mu=10, sigma=0.5 )), f = 0)
plot(cdf,main="cdf", ylab="cdf(x)", do.points=FALSE )
invcdf <-stepfun(seq(0.01,.99,length=39), qNBI(seq(0.01,.99,
                  length=40), mu=10, sigma=0.5 ), f = 0)
plot(invcdf,main="inverse cdf",ylab="inv-cdf(x)",do.points=FALSE)
tN <- table(Ni <- rNBI(1000,mu=5, sigma=0.5))
r <- barplot(tN, col='lightblue')
```




```
par(PPP)
```

Note that to find moments or to check if a distribution integrates or sums to one, the functions `integrate()` or `sum()` can be used. For example

```
integrate(function(y) dGA(y, mu=10, sigma=.1),0, Inf)
```

```
1 with absolute error < 2.8e-05
```

will check that the distribution integrates to one, and

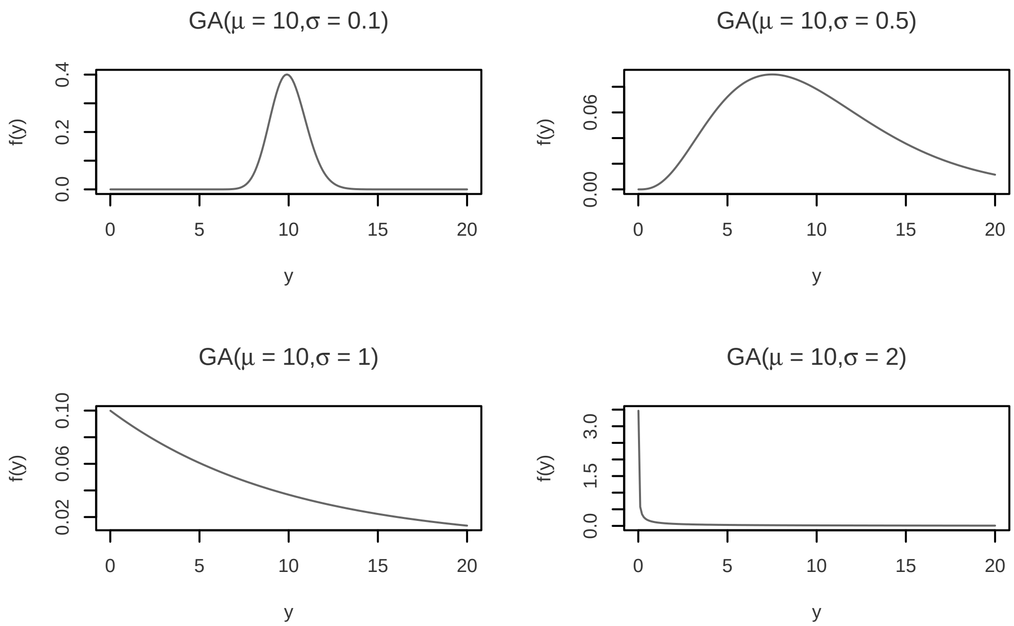
```
integrate(function(y) y*dGA(y, mu=10, sigma=.1),0, Inf)
```

```
10 with absolute error < 4e-04
```

will give the mean of the distribution.

The pdf of a GAMLSS family distribution can also be plotted using the `gamlss` function `pdf.plot()`. For example

```
pdf.plot(family=GA, mu=10, sigma=c(.1,.5,1,2), min=0.01,max=20,
         step=.5)
```



will plot the pdf's of four gamma distributions \`$GA$\`(μ, σ), all with $\mu = 10$, but with $\sigma = 0.1, 0.5, 1$ and 2, respectively.

Try plotting other continuous distributions, e.g. `IG` (inverse Gaussian), `PE` (power exponential) and `BCT` (Box-Cox t); and discrete distributions, e.g. `NBI` (negative binomial type I) and `PIG` (Poisson inverse Gaussian). Make sure you define the values of all the parameters of the distribution.

Turkish stock exchange: the `tse` data.

The data are for the eleven-year period 1 January 1988 to 31 December 1998. Continuously compounded returns in domestic currency were calculated as the first difference of the natural logarithm of the series. The objective is to fit a distribution to the Turkish stock exchange index.

- **R** data file: `tse` in package `gamlss.data` of dimensions 2868×6.
- `year`
- `month`
- `day`
- `ret`: day returns `ret[t]=ln(currency[t])-ln(currency[t-1])`
- `currency`: the currency exchange rate
- `tl` : day return `ret[t]=log10(currency[t])-log10(currency[t-1])`