

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 $y = 0, 1, 2, 3, \dots$
 2. Beta binomial **BB** for $y = 0, 1, 2, 3, \dots, n$
- Mixed distributions
 1. Zero adjusted gamma **ZAGA** for $0 \leq y < \infty$
 2. Beta inflated **BEINF** for $0 \leq y \leq 1$

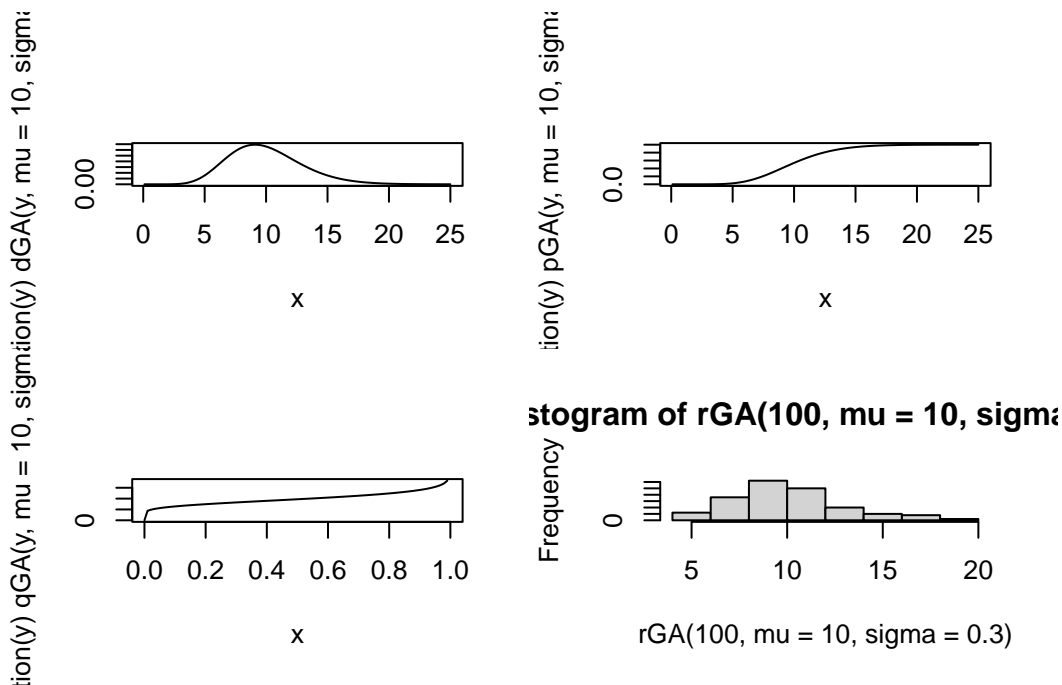
Plotting different distributions

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:

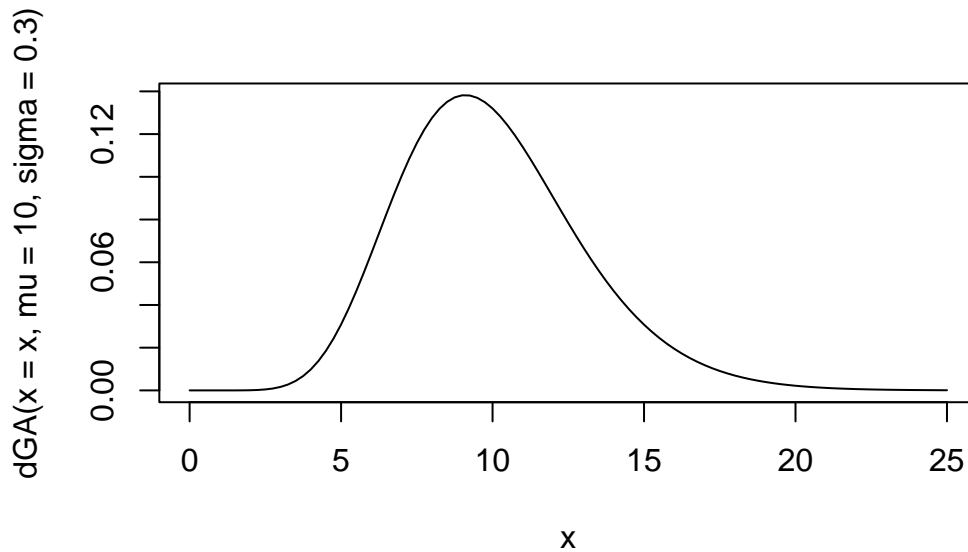
```
PPP <- par(mfrow=c(2,2))
plot(function(y) dGA(y, mu=10 ,sigma=0.3),0.1, 25) # pdf
plot(function(y) pGA(y, mu=10 ,sigma=0.3), 0.1, 25) #cdf
plot(function(y) qGA(y, mu=10 ,sigma=0.3), 0, 1) # inverse cdf
hist(rGA(100,mu=10,sigma=.3)) # randomly generated values
```



```
par(PPP)
```

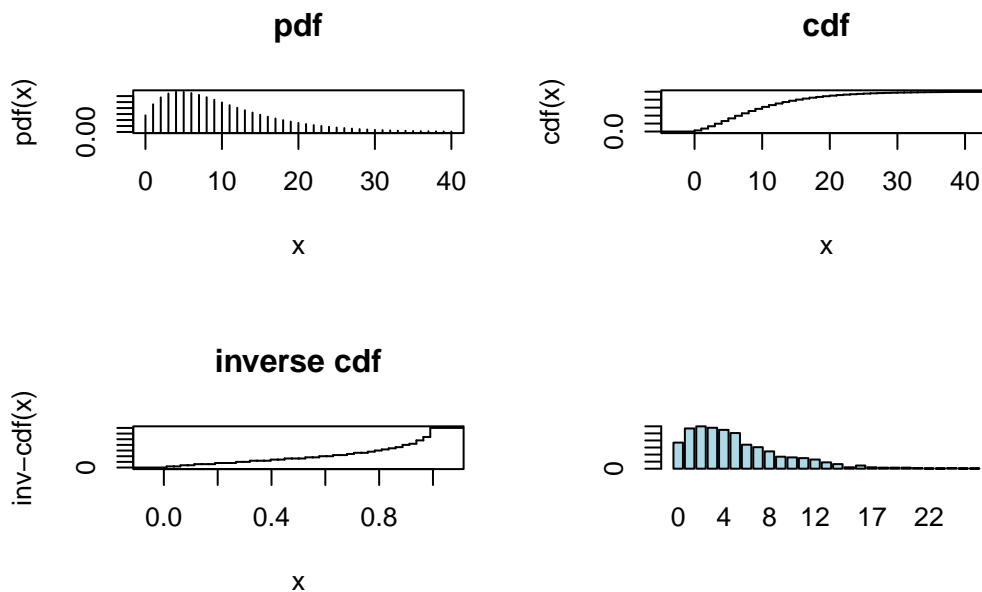
Note that the first three plots above can also be produced by using the function `curve()`, for example

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



To explore discrete distributions use:

```
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

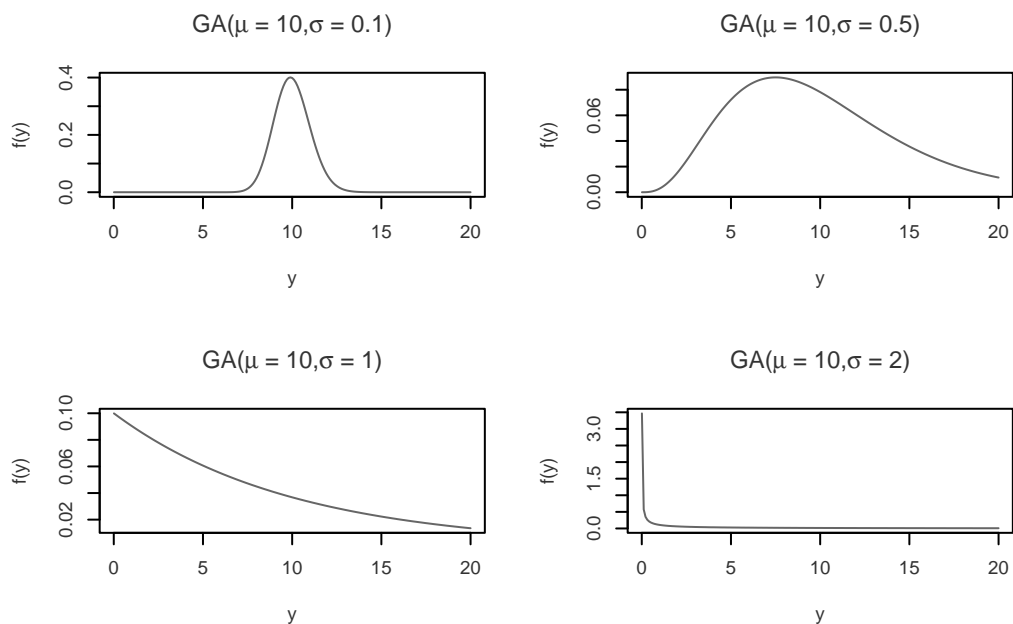
```
integrate(function(y) y*dGA(y, mu=10, sigma=.1),0, Inf)
```

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 $GA(\mu, \sigma)$, 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 $\text{ret}[t] = \ln(\text{currency}[t]) - \ln(\text{currency}[t-1])$
- `currency`: the currency exchange rate
- `t1`: day return $\text{ret}[t] = \log_{10}(\text{currency}[t]) - \log_{10}(\text{currency}[t-1])$