lecture 2.2 example 1

preliminaries

```
# clear environment
rm(list = ls())

# set random seed
set.seed(123)
```

define params

```
# define true parameters of the data generating process
pTrue = 0.7

# define data set size
nData = 100

# prior params
aPrior = 1
bPrior = 1
```

simulate dataset

```
data = rbinom(n = nData, size = 1, prob = pTrue)
nWater = sum(data)
```

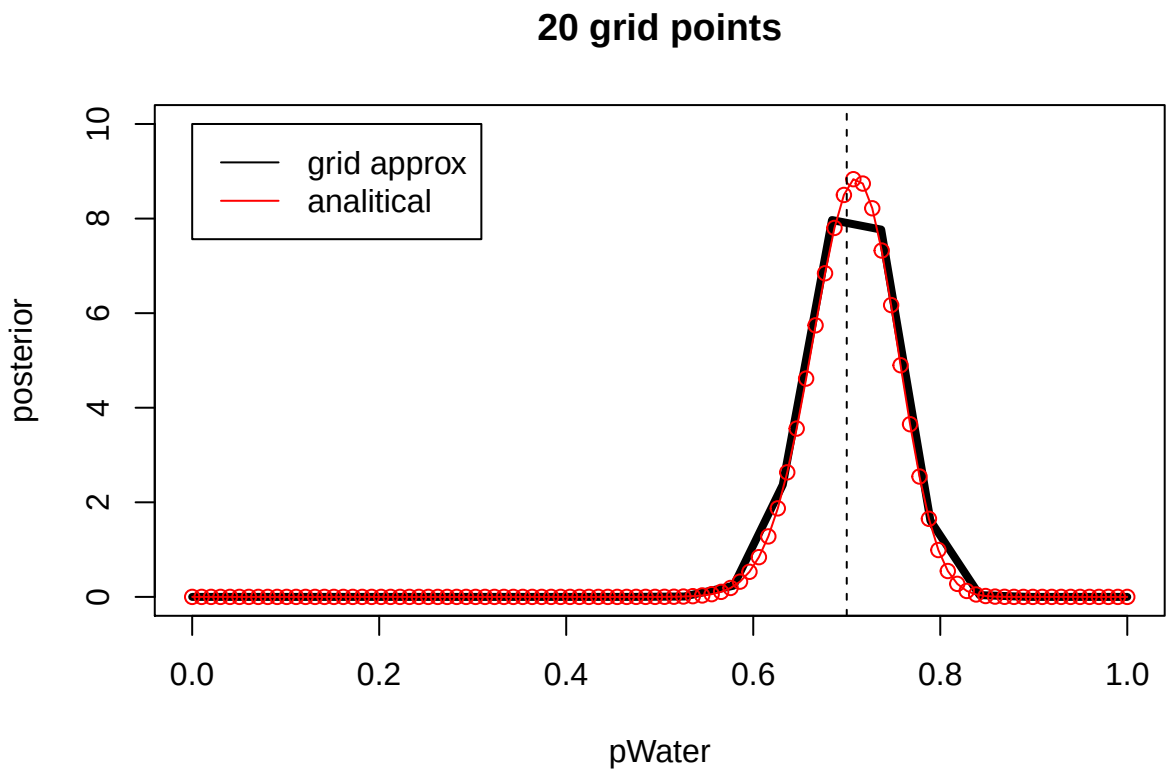
build simulation functions

```
prior <- function(nGridPoints) {
  pGrid = seq(from = 0, to = 1,length.out = nGridPoints)
  prior = dbeta(x = pGrid, shape1 = aPrior, shape2 = bPrior)
}

compute_posterior <- function(nGridPoints) {
  #build grid
  pGrid = seq(from = 0, to = 1,length.out = nGridPoints)
  gridSize = 1 / nGridPoints
  # compute likelihood
  likelihood = dbinom(x = nWater, size = nData, prob = pGrid)
  # compute posterior
  postGrid = likelihood * prior(nGridPoints)
  postGrid = postGrid / ( sum(postGrid) * gridSize )
  #
  return(postGrid)
}
```

simulations: 20 grid points

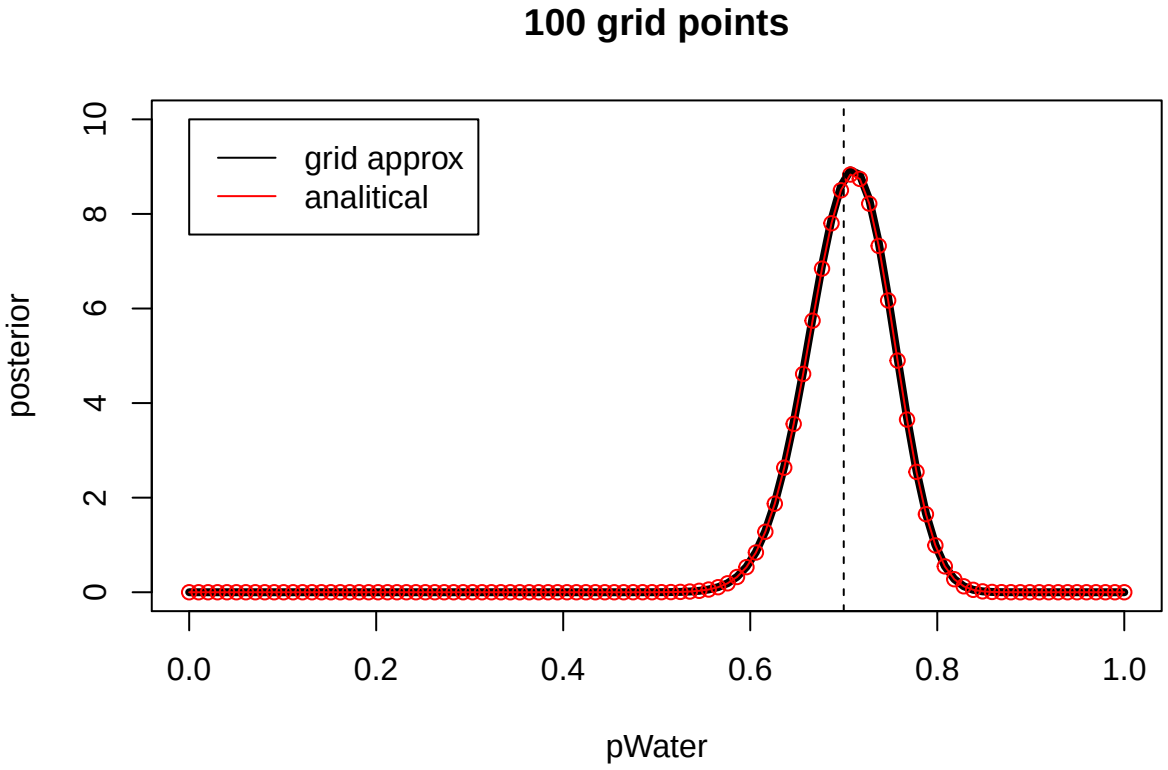
```
# note that analytical solution plotted with 100-point grid resolution
pGrid = seq(from = 0, to = 1,length.out = 20)
plot(pGrid, compute_posterior(20), type="l", lwd=4,
     xlab = "pWater", ylab = "posterior",
     ylim = c(0,10), main = "20 grid points")
gridAnalytical = seq(from = 0, to = 1,length.out = 100)
postAnalytical = dbeta(gridAnalytical, aPrior + nWater, bPrior + nData - nWater)
points(gridAnalytical, postAnalytical, col = 'red')
points(gridAnalytical, postAnalytical, type = "l",col = 'red')
abline(v = pTrue, lty=2)
legend(0,10, legend = c("grid approx", "analitical"),
       col = c("black","red"), lty=c(1,1) )
```



##

simulations: 100 grid points

```
pGrid = seq(from = 0, to = 1,length.out = 100)
plot(pGrid, compute_posterior(100), type="l", lwd=4,
     xlab = "pWater", ylab = "posterior",
     ylim = c(0,10), main = "100 grid points")
gridAnalytical = seq(from = 0, to = 1,length.out = 100)
postAnalytical = dbeta(gridAnalytical, aPrior + nWater, bPrior + nData - nWater)
points(gridAnalytical, postAnalytical, col = 'red')
points(gridAnalytical, postAnalytical, type = "l",col = 'red')
abline(v = pTrue, lty=2)
legend(0,10, legend = c("grid approx", "analitical"),
       col = c("black","red"), lty=c(1,1) )
```


100 grid points
grid approx
analitical
posterior
0
2
4
6
8
10
0.0
0.2
0.4
0.6
0.8
1.0
pWater