1. In order to compute $100(1 - \alpha)\%$ confidence interval, it is required to find $z_{\alpha/2}$ that satisfies 
$P(Z > z_{\alpha/2}) = \alpha/2$ for given $\alpha$. We will study how to find $z_{\alpha/2}$ and more. This lecture is based on Chapter 4.6.

2. The $p$-th quantile point $q$ for random variable $X$ is the point such that 
$F(q) = P(X \leq q) = p$. 
The textbook represent it in terms of percentile. 
Note that $p$-th quantile $= 100 \times p$-th percentile. So given $p$, 
$q = F^{-1}(p)$. 
For $X \sim N(0, 1)$, it is easy to find the $p$-th quantile using 

```r
> qnorm(1)
[1] Inf
> qnorm(0.5)
[1] 0
> qnorm(0)
[1] -Inf
> qnorm(0.5)
[1] 1
> qnorm(0.95)
[1] 1.644854
> qnorm(0.05)
[1] -1.644854
```

In order to find $z_\alpha$, we use command `qnorm(1-\alpha)`.

3. Given $n$ observations $x_1, \ldots, x_n$, we order them from the smallest to the largest and we have $x_{(1)}, \ldots, x_{(n)}$. The $i$-th smallest observation is defined as the $(i - 0.5)/n$-th sample quantile point or $100(i - 0.5)/n$ sample percentile point.

```r
> library(Devore6)
> data(xmp01.05)
```

4. If bingePct really follows $N(42, 14^2)$, then the sample quantiles should be resonably close to the corresponding quantiles of the normal distribution. The corresponding quantile points for bingePct can be computed using 

```r
> q=qnorm((1:140-0.5)/140,42,14)
```

We can check how closely the sample quantiles corresponds to the normal distribution by plotting the quantile-quantile plot (QQ-plot) of the sample quantiles vs. the corresponding quantiles of a normal distribution (Figure 1).

```r
> plot(q,sq)
```

5. If $X \sim N(\mu, \sigma^2)$, then 

$$Z = \frac{X - \mu}{\sigma} \sim N(0, 1).$$
The $p$-th quantile of $X$ is given by

$$p = P(X \leq q) = P\left( \frac{X - \mu}{\sigma} \leq \frac{q - \mu}{\sigma} \right) = P\left( Z \leq \frac{q - \mu}{\sigma} \right).$$

The quantile point $q$ of $N(\mu, \sigma^2)$ corresponds to the quantile point $(q - \mu)/\sigma$ of $N(0, 1)$. So we do not need to find the quantile points of $N(\mu, \sigma^2)$. All we need is the quantile points of $N(0, 1)$ for checking normality. It can be easily done using command

> qqnorm(bingePct)

This plot (Figure 2) is usually referred as the normal probability plot.

6. What would happen if we plot data that do not follow a normal distribution?