MA4413 Statistics for Computing

Lecture images/ : Normal Distribution

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Autumn 2012

Today's Class

- More on the Normal Distribution
  - Last class: definitions related to statistical inference.
  - Fundamental part of statistical inference is the Central Limit Theorem.
  - CLT based on Normal Distribution.
- Introduction to Quantile functions
  - The `qnorm` function
- A revision of the course material relevant to the mid-term.

Probability Density Function

Recall: As the Normal distribution is a continuous distribution, the PDF for a particular observed value will not give us an intuitive result (as far as this module is concerned). It is, in fact, the height of the density curve at a particular point.
Nonetheless, the relevant R code may be included in exam questions, so as to add complexity to questions.

```
> dnorm(0.7)
[1] 0.3122539
>
> dnorm(1.7)
[1] 0.09404908
```

Sample Question

Suppose X is a normally distributed random variable with mean $\mu = 2000$ and standard deviation $\sigma = 200$. Compute the probability of X being less than (or equal to) 2340.

$$P(X \leq 2340)$$

As always, we compute the z-score that corresponds to 2340.

$$z_o = \frac{x_o - \mu}{\sigma} = \frac{2340 - 2000}{200} = 1.7$$

R Implementation

Using the following R code, we can determine $P(Z \leq 1.7)$.

```
> pnorm(1.7)
[1] 0.9554345
```

Direct R Implementation

This can easily be implemented directly - without using the standardization formula, by specifying the normal mean and normal standard deviation directly. However, we will not be using this approach in this module.

```
> pnorm(2340,mean=2000,sd=200)
[1] 0.9554345
```