

Chapter 3

Mathematics in daily life

Part 2

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Ch.3.2

→ 3.4 Convolution

→ 3.5 Risk of Ruin

3.4 Convolution

If one event was occurred because of doing some activities, operation of doing two things together/joint along time series this event call “convolution”.

Convolution is a mathematical operation of 2 functions , producing a third function that is typically viewed as a modified version of one of the original functions, giving the area overlap between the two functions as a function of the amount that one of the original functions is translated [1]

Source [1]: <http://en.wikipedia.org/wiki/Convolution>



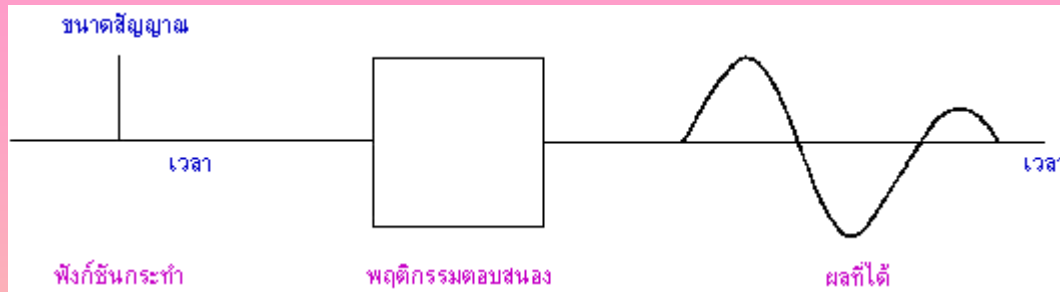


Figure 1. Wave vibration from smashing soil that distribute along time series.

Example:

Smashing the soil at time-t , the soil will receive the energy from this action it causes wave vibration.

Convolution and related operations are found in many applications of many field such as science, engineering, economics and mathematics.



Example 1

To promote the new theory of agricultural plantation, the Agricultural Co-Operatives (BAAC) announce to agriculture who live in Damnoen Saduak district, Ratchaburi, Thailand, for doing soft loan. The period of load is 7 weeks for 1 Rai per one family.

The agriculture were separated into 3 groups

Group #1 total 3 families

Group #2 total 4 families

Group #3 total 5 families

***Each group are about to start working one week away.**

How much does it cost of the plan of BAAC for soft-loan preparation for each weeks ? How much of time consume for this project.

Week No.	Expense Items	Cost (Baht)
1	Seed and plant-labors	1,000
2	Repairing seed	500
3 – 6	Fertilizer and insect-chemical	
	(will increasing cost 200 baht per week)	2,000
7	Harvest labors	500

Please answer those question below

1. What is the input function ?.....
2. What is the Response function?.....
3. How much does the period of this sequence event?

SOLVE

week	1	2	3	4	5	6	7				
0	0	1	0.5	2	2.2	2.4	2.6	0.5	0	0 (*10 ³ Baht)	
5	4	3	$(5*0) + (4*0) + (3*1) = 3$			thousand baht					
	5	4	3	$(5*0) + (4*1) + (3*0.5) = 5.5$			thousand baht				
		5	4	3 = 13 * 10 ³ baht						
			5	4	3 = 17.1 * 10 ³ baht					
				5	4	3 = 26 * 10 ³ baht				
					5	4	3 = 28.4 * 10 ³ baht			
						5	4	3 = 23.9 * 10 ³ baht		
							5	4	3 = 15 * 10 ³ aht	
								5	4	3 = 2.5*10 ³ baht

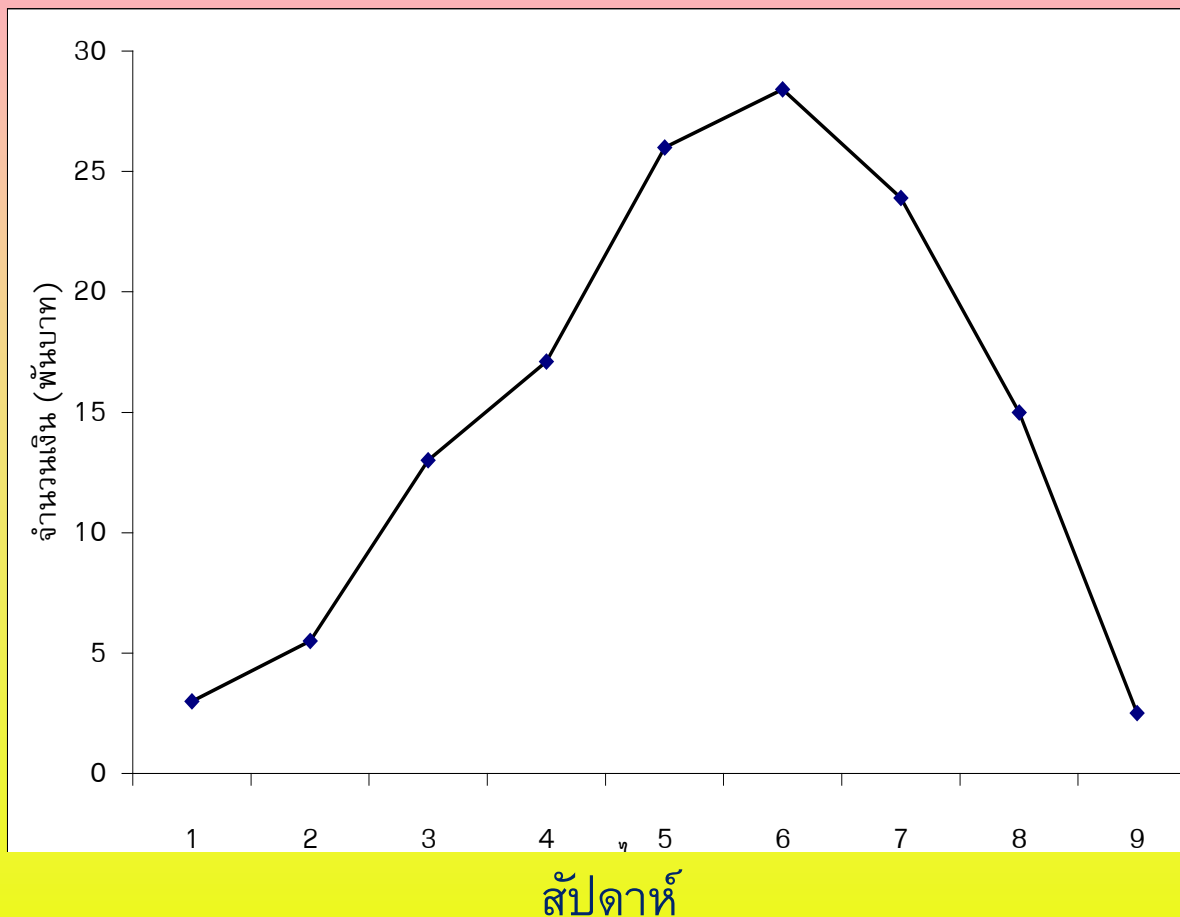
Total 9 weeks Bank for Agriculture and Agricultural Co-Operatives (BAAC) will use the budget 134,400 Baht

Convolution

Input function => Budget expense every weeks

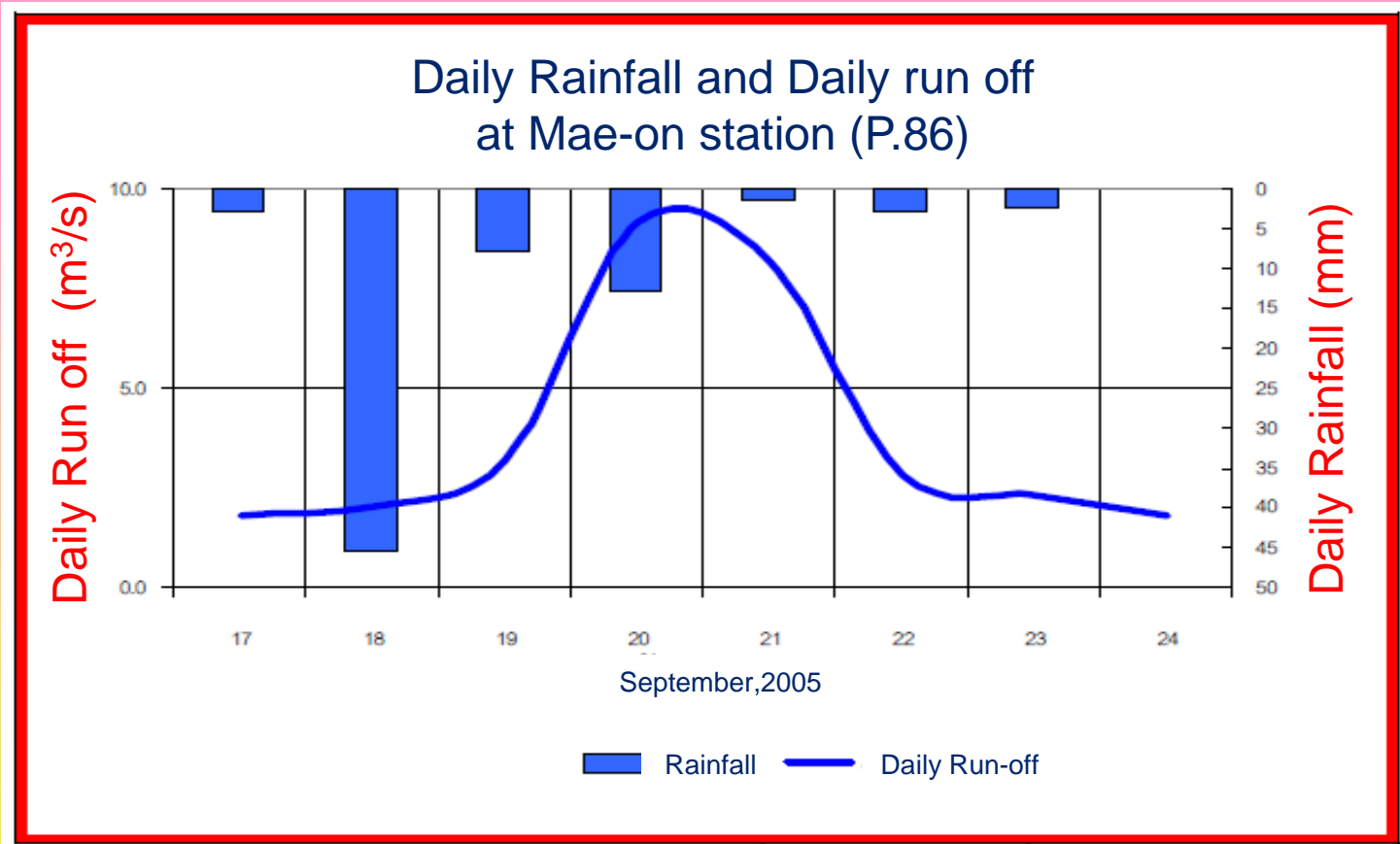
Behavior/ response => BAAC loan

Output/response function => Total BAAC budget of each weeks.



Maximum budget use at week#6 and the last week use minimum budget (week#9)

Practice



Input function =>

Daily Rainfall

Respond =>

River basin/ unit daily runoff

Output or response function =>

Daily runoff

Maximum flood occur on September 20 ,2005

3.5 Risk of Ruin

- Do you know your Risk of Ruin?
- Trading is a risky business and so many people who enter the trading world fail, losing large amounts of money in the process.
- Have you already lost a large sum of money or are you on the path to becoming another trading statistic? How do you know?
- Brent Penfold from IndexTrader.com.au, who has been trading successfully since the 1980's and was a guest in Episode 2 of the Better System Trader podcast here, believes “why people lose is essentially most people are clueless about this key concept, Risk of Ruin.”
- Are you currently trading a system with money management that is destined to fail? To find out, you need to calculate your Risk of Ruin and we're going to show you how.
- What is Risk of Ruin?
- Risk of ruin is the probability that you'll lose so much money you can no longer continue trading. This doesn't mean losing all of your trading capital, the ruin point is based on your own personal risk tolerance, so ruin to you could be 15%, it could be 50% or it could be 100%.



Risk theory refers to a body of techniques to model and measure the risk associated with a portfolio of insurance contracts. A first approach consists in modeling the distribution of total claims over a fixed period of time using the classical collective model of risk theory. A second input of interest to the actuary is the evolution of the surplus of the insurance company over many periods of time. In ruin theory, the main quantity of interest is the probability that the surplus becomes negative, in which case technical ruin of the insurance company occurs



The term risk of ruin refers to the probability an individual could lose all of their capital investments and the recovery of loss is not possible. The risk of ruin concept has its roots in the gambling industry, but has since been associated with both the investing and insurance industries.

Calculation

$$\text{Risk of Ruin} = \left(\frac{1 - (W - L)}{1 + (W - L)} \right)^U$$

Where:

- W = the probability of a desirable outcome, or a win
- L = the probability of an undesirable outcome, or a loss
- U = the maximum number of risks that can be taken before the individual reaches their threshold for ruin

Example:

Historically, a trader conducts a successful transaction 52% of the time, and 48% of the time they lose the entire investment. In this example, the trader's total funds are \$100,000, each trade involves \$5,000, and the trader's point of ruin is \$70,000. This means the maximum number of risks the trader can take before reaching their point of ruin is $\$70,000 / \$5,000$, or 14.

The risk of ruin would be calculated as:

$$= ((1 - (0.52 - 0.48)) / (1 + (0.52 - 0.48)))^{14}$$

$$= ((1 - 0.04) / (1 + 0.04))^{14}$$

$$= (0.96 / 1.04)^{14}$$

$$= 0.923114, \text{ or } 0.3261, \text{ or } 32.61\%$$

Questions?

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Reference:

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2. วีระศักดิ์ อุดมโชค , Lecture note คณิตศาสตร์และคอมพิวเตอร์ในชีวิตประจำวัน, 2551,
ภาควิชาวิทยาศาสตร์พื้นฐาน คณะวิทยาศาสตร์ มก.
- 3: <http://www-metdat.llnl.gov/cgi-pub/about.pl>