THE FIRST ASSIGNMENT: Translate from English to Serbian an excerpt from Russinovich's book *Windows Internals*, page 197

Run Once Initialization

The ability to guarantee the atomic execution of a piece of code responsible for performing some sort of initialization task—such as allocating memory, initializing certain variables, or even creating objects on demand—is a typical problem in multithreaded programming. In a piece of code that can be called simultaneously by multiple threads (a good example is the DllMain routine, which initializes DLLs) there are several ways of attempting to ensure the correct, atomic, and unique execution of initialization tasks.

In this scenario, Windows implements init once, or one-time initialization (also called run once initialization internally). This mechanism allows for both synchronous (meaning that the other threads must wait for initialization to complete) execution of a certain piece of code, as well as asynchronous (meaning that the other threads can attempt to do their own initialization and race) execution. We'll look at the logic behind asynchronous execution later after explaining the synchronous mechanism.

In the synchronous case, the developer writes the piece of code that would normally have executed after double-checking the global variable in a dedicated function. Any information that this routine needs can be passed through the parameter variable that the init-once routine accepts. Any output information is returned through the context variable (the status of the initialization itself is returned as a Boolean). All the developer has to do to ensure proper execution is call InitOnceExecuteOnce with the parameter, context, and run-once function pointer after initializing an InitOnce object with InitOnceInitialize API. The system will take care of the rest.

For applications that want to use the asynchronous model instead, the threads call InitOnceBeginInitialize and receive a pending status and the context described earlier. If the pending status is FALSE, initialization has already taken place, and the thread uses the context value for the result. (It's also possible for the function itself to return FALSE, meaning that initialization failed.) However, if the pending status comes back as TRUE, the thread should now race to be the first to create the object. The code that will follow will perform whatever initialization tasks are required, such as creating some sort of object or allocating memory. When this work is done, the thread calls InitOnceComplete with the result of the work as the context and receives a status. If the status is TRUE, the thread won the race, and the object it created or allocated should be the global object. The thread can now save this object or return it to a caller, depending on the usage.

In a more complex scenario when the status is FALSE, this means that the thread lost the race. The thread must now undo all the work it did, such as deleting the object or freeing the memory, and then call InitOnceBeginInitialize again. However, instead of requesting to start a race as it did initially, it uses the INIT_ONCE_CHECK_ONLY flag, knowing that it has lost, and requests the winner's context instead (for example, the object or memory that had to be created or allocated).

THE SECOND ASSIGNMENT:

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IMPORTANT NOTE:

A) This assignment is based on an excerpt taken from the following source: https://en.wikipedia.org/wiki/Bounded_function

Students are required to **translate the text from English into Serbian**.

The task is purely a translation exercise. No rewriting, summarizing, or interpretation is required.

A function f defined on a set X with real or complex values is called bounded if the set of its values (its image) is bounded.

In other words, there exists a real number M such that:

$|f(x)| \leq M$

for all x in X.

A function that is not bounded is called unbounded.

If f is real-valued and:

$f(x) \leq A$ for all x in X,

then f is bounded above by A.

If:

$f(x) \geq B$ for all x in X,

then f is bounded below by B.

A real-valued function is bounded if and only if it is both bounded above and bounded below.

An important special case is a bounded sequence, where X is the set of natural numbers N.

A sequence f = (a0, a1, a2, …) is bounded if there exists a real number M such that:

$|an| \leq M$

for every natural number n.

The set of all bounded sequences forms the sequence space l^∞.

The definition of boundedness can be generalized to functions f: X → Y taking values in a more general space Y by requiring that the image f(X) is a bounded set in Y.

Related notions:

Weaker than boundedness is local boundedness.

A family of bounded functions may be uniformly bounded.

A bounded operator T: X → Y is not a bounded function in the usual sense (unless T = 0), but it preserves bounded sets:

If $M \subseteq X$ is bounded, then $T(M) \subseteq Y$ is also bounded.

This notion extends to general functions when X and Y have a notion of bounded sets.

Examples:

The sine function sin: R → R is bounded since:
$|\sin(x)| \leq 1$ for all x in R.

The function $f(x) = 1 / (x^2 - 1)$, defined for all real x except $x = -1$ and $x = 1$, is unbounded because it grows without bound near those points.

The function $f(x) = 1 / (x^2 + 1)$, defined for all real x, is bounded since:
$|f(x)| \leq 1$ for all x.

The arctangent function y = arctan(x) is bounded with:
$-\pi/2 < y < \pi/2$.

Every continuous function on a closed interval [a, b] is bounded.

More generally, every continuous function from a compact space into a metric space is bounded.

Every entire complex function f: C → C is either unbounded or constant (Liouville’s theorem).

In particular, sin(x) on complex numbers is unbounded.

The Dirichlet function (0 for rationals, 1 for irrationals) is bounded.

Continuous functions need not be bounded on non-compact domains, for example:

$g(x, y) = x + y$
$h(x, y) = 1 / (x + y)$

B)

assignmen 2: https://en.wikipedia.org/wiki/Periodic_function

A periodic function is a function that repeats its values at regular intervals. For example, the trigonometric functions, which are used to describe waves and other repeating phenomena, are periodic. Many aspects of the natural world have periodic behavior, such as the phases of the Moon, the swinging of a pendulum, and the beating of a heart.

The length of the interval over which a periodic function repeats is called its period. Any function that is not periodic is called aperiodic.

Definition

A graph of the sine function. It is periodic with a fundamental period of 2π.

A function is defined as periodic if its values repeat at regular intervals. For example, the positions of the hands on a clock display periodic behavior as they cycle through the same positions every 12 hours. This repeating interval is known as the period.

More formally, a function f is periodic if there exists a constant P such that

$f(x + P) = f(x)$

for all values of x in the domain. A nonzero constant P for which this condition holds is called a period of the function.

If a period P exists, any integer multiple nP (for a positive integer n) is also a period. If there is a least positive period, it is called the fundamental period (also primitive period or basic period). Often, "the" period of a function is used to refer to its fundamental period.

Geometrically, a periodic function's graph exhibits translational symmetry. Its graph is invariant under translation in the x-direction by a distance of P. This implies that the entire graph can be formed from copies of one particular portion, repeated at regular intervals.

Examples

Periodic behavior can be illustrated through both common, everyday examples and more formal mathematical functions.

Real-valued functions

Functions that map real numbers to real numbers can display periodicity, which is often visualized on a graph.

Sawtooth wave

An example is the function f that represents the "fractional part" of its argument. Its period is 1. For instance,

$f(0.5) = f(1.5) = f(2.5) = ... = 0.5$

The graph of the function f is a sawtooth wave.

Trigonometric functions

A plot of $f(x) = \sin(x)$ and $g(x) = \cos(x)$; both functions are periodic with period 2π.

The trigonometric functions are common examples of periodic functions. The sine function and cosine function are periodic with a fundamental period of 2π, as illustrated in the figure to the right. For the sine function, this is expressed as:

$$\sin(x + 2\pi) = \sin x$$

for all values of x.

The field of Fourier series investigates the concept that an arbitrary periodic function can be expressed as a sum of trigonometric functions with matching periods.

Exotic functions

Some functions are periodic but possess properties that make them less intuitive. The Dirichlet function, for example, is periodic, with any nonzero rational number serving as a period. However, it does not possess a fundamental period.

Complex-valued functions

Functions with a domain in the complex numbers can exhibit more complex periodic properties.

Complex exponential

The complex exponential function is a periodic function with a purely imaginary period:

$$e^{ikx} = \cos(kx) + i \sin(kx)$$

Given that the cosine and sine functions are both periodic with period 2π, Euler's formula demonstrates that the complex exponential function has a period L such that

$$L = 2\pi / k$$

Double-periodic functions

A function on the complex plane can have two distinct, incommensurate periods without being a constant function. The elliptic functions are a primary example of such functions. ("Incommensurate" in this context refers to periods that are not real multiples of each other.)

Properties

Periodic functions can take on values many times. More specifically, if a function f is periodic with period P, then for all x in the domain of f and all positive integers n,

$$f(x + nP) = f(x)$$

A significant property related to integration is that if $f(x)$ is an integrable periodic function with period P, then its definite integral over any interval of length P is the same. That is, for any real number a:

$$\int_{a}^{a+P} f(x)\,dx = \int_{0}^{P} f(x)\,dx$$

If f(x) is a function with period P, then f(ax), where a is a non-zero real number such that ax is within the domain of f, is periodic with period P / |a|. For example, f(x) = sin(x) has period 2π and therefore sin(5x) will have period 2π / 5.

A key property of many periodic functions is that they can be described by a Fourier series. This series represents a periodic function as a sum of simpler periodic functions, namely sines and cosines. For example, a sound wave from a musical instrument can be broken down into the fundamental note and various overtones. This decomposition is a powerful tool in fields like physics and signal processing. While most "well-behaved" periodic functions can be represented this way, Fourier series can only be used for periodic functions or for functions defined on a finite length.

Any function that is a combination of periodic functions with the same period is also periodic (though its fundamental period may be smaller). This includes:

addition, subtraction, multiplication and division of periodic functions,
taking a power or a root of a periodic function (provided it is defined for all x)

Generalizations

The concept of periodicity can be generalized beyond functions on the real number line. For example, the idea of a repeating pattern can be applied to shapes in multiple dimensions, such as a periodic tessellation of the plane. A sequence can also be viewed as a function defined on the natural numbers, and the concept of a periodic sequence is defined accordingly.

Antiperiodic functions

One subset of periodic functions is that of antiperiodic functions. This is a function f such that

f(x + P) = -f(x)

for all x. For example, the sine and cosine functions are π-antiperiodic and 2π-periodic. While a P-antiperiodic function is a 2P-periodic function, the converse is not necessarily true.

Bloch-periodic functions

A further generalization appears in the context of Bloch's theorems and Floquet theory, which govern the solution of various periodic differential equations. In this context, the solution (in one dimension) is typically a function of the form

f(x + P) = e^(ikP) f(x),

where k is a real or complex number (the Bloch wavevector or Floquet exponent). Functions of this form are sometimes called Bloch-periodic in this context. A periodic function is the special case k = 0, and an antiperiodic function is the special case k = π / P. Whenever kP / π is rational, the function is also periodic.

Quotient spaces as domain

In signal processing you encounter the problem that Fourier series represent periodic functions and that Fourier series satisfy convolution theorems (i.e. convolution of Fourier series corresponds to multiplication of represented periodic function and vice versa), but periodic functions cannot be convolved with the usual definition, since the involved integrals diverge. A possible way out is to define a periodic function on a bounded but periodic domain. To this end you can use the notion of a quotient space:

$R / Z = \{x + Z : x \in R\} = \{\{y : y \in R \wedge y - x \in Z\} : x \in R\}$.

That is, each element in R / Z is an equivalence class of real numbers that share the same fractional part. Thus a function like $f : R / Z \to R$ is a representation of a 1-periodic function.

Calculating period

Consider a real waveform consisting of superimposed frequencies, expressed in a set as ratios to a fundamental frequency, f: F = 1/f [f1 f2 f3 ... fN] where all non-zero elements ≥1 and at least one of the elements of the set is 1. To find the period, T, first find the least common denominator of all the elements in the set. Period can be found as T = LCD / f. Consider that for a simple sinusoid, T = 1/f. Therefore, the LCD can be seen as a periodicity multiplier.

For set representing all notes of Western major scale: [1 9/8 5/4 4/3 3/2 5/3 15/8] the LCD is 24 therefore T = 24/f.

For set representing all notes of a major triad: [1 5/4 3/2] the LCD is 4 therefore T = 4/f.

For set representing all notes of a minor triad: [1 6/5 3/2] the LCD is 10 therefore T = 10/f.

If no least common denominator exists, for instance if one of the above elements were irrational, then the wave would not be periodic.

THE THIRD ASSIGNMENT: Translate from English to Serbian an excerpt from the story *"Memories of Moments, Bright as Falling Stars"* by Cat Rambo

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IMPORTANT NOTE:
This is an excerpt from a literary story. The task is to translate the text from English to Serbian while preserving tone, narrative voice, and informal conversational style.

MEMORIES OF MOMENTS, BRIGHT AS FALLING STARS
by Cat Rambo

By Cat Rambo I was surprised; I'd never heard Ajah make anyone an offer like that.

"The Exams are your big chance. Get a good night's sleep and make the most of them. Face them fully charged."

I rolled my eyes. “For what? Like there’s a chance.” But he and Grizz ignored me.

“We need to make a library run still,” she said.

“Yeah, yeah, that’s fine. I’m up till midnight, maybe later,” Ajah told her.

Despite my doubts, relief seeped into my bones. We’d been given a night’s respite, and who knew what would happen after the Exams? “Thanks, Ajah,” I said, and he grunted acknowledgement as he slid a plate before me.

The portabella bits had been browned in curry powder and oil, and the eggs were fresh and good. Grizz ate methodically, scraping her plate free, but she looked up to catch my eye and gave me a heartfelt smile, rare on her square-set face.

As her gaze swung back to her plate, my glance tangled with Lorelei’s. I could not read her expression.

Lorelei and I used to pal around before Grizz and I met up. She and I grew up next to each other, and it’s hard not to know someone intimately when you’ve shared hour after hour channel surfing while one mother or the other went out on work or errands. We suffered through the same street bullies and uninterested teachers. She was the first girl I ever kissed. You don’t forget that.

But I knew I wanted Grizz for keeps the first moment I saw her. She came swaggering into the shelter wearing a rabbit-fur jacket and pseudo-leather pants. She’d been tricking in a swank bar, but then someone snatched all her hard-earned cash. So there she was, with a bruise on her face and a cracked wrist, but still holding herself hard and arrogant, and the only person in the world who could glimpse the softness underneath was me, it seemed like. So I sauntered up, invited her outside for a smoke, and then within a half hour, we were pressed against the wall together, my hands up her shirt like I’d never touched her before, feeling her firm little nipples against the skin of my palms.