**Stack Definition using Mathematical notation**

We can suppose that following symbols are:

X: element’s type in a Stack

S: Stack

x: element in a Stack

We are also assuming that we are calling these functions with the stack pointer that exist. Undeclared stack pointer will yield Null.

Size: len(S: Stack)

Thus, Size returns length of stack which is list.

Empty: if **[nil]** then **True** else **False**

Thus, Empty returns True if and only if stack contains nothing.

Push: < S: stack 🡪 < x: int 🡪 **S+[x]** >>

Thus, Push returns a new stack with new element added at the end of list/stack.

Pop: < S: stack 🡪 if S=**Empty** then **[Nil]** else **S[0,1,…#S-1]** fi >

Thus, Pop returns a new stack without last element in a stack/list if and only if stack is not empty.

Top: < S: stack 🡪 if S=**Empty** then **Null** else **S(#S-1)** fi >

Thus, Top return the last element of list/stack if and only if stack is not empty.

Reference:

[1]. R. Neff, *Metaphors Be With You*. [Online]. Available: https://rickneff.github.io/metaphors-be-with-you.html#outline-container-org32e5c89. [Accessed: 27-Oct-2019].

[2]. Neff, R. (2019). *Help with Stack Definition in Mathematical Notation*.

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[4]. Larsen, Peter Gorm, et al. *Overture – Open-Source Tools for Formal Modelling*.

[5]. K. Klement, "Propositional Logic Reference," *Internet Encyclopedia of Philosophy*, Retrieved 15 December 2015.  
[Online] Available: <http://www.iep.utm.edu/prop-log>

[6]. “Stacks, Queues, and Linked List.” *Https://Www.cs.purdue.edu*, www.cs.purdue.edu/homes/ayg/CS251/slides/chap3.pdf.

Self Grading:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Exceptional 100% | Good 90% | Acceptable 70% | Developing 50% | Missing 0% |
| Reference 30% | The source cited is reputable and complete describes the notation used. | The citation is "sound" and is correctly referenced. | The source is of insufficient quality. | The notation cited is not appropriate for the stack. | No formal notation is cited. |
| Formality 40% | It is possible to conduct a formal proof from this definition. | Every aspect of the stack behavior was *modeled*. | The notation was syntactically correct | Every aspect of the stack behavior was *described to some degree*. | Large components of the definition are up for interpretation. |
| Correctness 20% | The description is unambiguously correct. | All the behaviors of the stack are correctly modeled. | A minor error exists in the definition of one of the interfaces. | One major error exists or multiple minor errors exist. | The model does not resemble the stack. |
| Professional 10% | All ideas were clearly and elegantly presented. | Everything was done professionally. | One aspect of the write-up was unprofessional. | The quality of the write-up was below what one would expect from a senior. | Extreme difficulty in readability, etc. |