HW#5: Understanding Continuations (7 points)

Goal: This HW#5 will help you understand the basic concept of continuations (See slides for L23 ~ L25).

This homework is doing a survey on continuations. You may discuss with your classmates but all answers must be written in your own words. You can refer to lecture notes, slides, and all other materials/references to accomplish HW5.

Problems

1. (1 point) Describe your understanding about continuations. Provide examples and references you read and found.
   Ans)
   A continuation is where a function continues.

   ex)
   for(int i = 0 ; i < 10 ; i++) {
   printf(“hello PLT class\n”) ;
   }
   In for loop, when i = 5, the continuation is “for()” function with range i = 6 to i = 9.

   Reference)
   https://www.youtube.com/watch?v=2GfFlfToBCo
   https://www2.cs.sfu.ca/CourseCentral/383/tjd/racket_cps.html

2. (1 point) Explain about call/cc in detail. Provide examples and references you read and found.
   Ans)
   ‘call/cc’ only takes only one parameter and that parameter is continuation. And the current continuation is passed to parameter. And the principle is to capture what is currently on the stack and store it in the heap as a lambda function.

ex)
(+ (* (call/cc (lambda (k) (k 2))) 3) 10) ; → 16
Explain: (call/cc (lambda (k) (k 2))) == v →
continuation = k = (lambda (v) (+ (* v 3) 10)) → (k 2) == 16

Reference)
https://www.youtube.com/watch?v=2GfFlfToBCo
https://www2.cs.sfu.ca/CourseCentral/383/tjd/racket_cps.html

3. (2 point) Explain about Continuation Passing Style (CPS) with real code examples from the internet or any references. You must explain the example code in your own words.
   Ans)
   CPS is Continuation passing Style. Therefore, it is a programming style in which functions do not return a value. Instead, use a continuation to transfer control.

   ```
   (define (+c x y k)
           (k (+ x y))
   (+c 2 3 (lambda (x) x))
   ```

   In this code, '(lambda (x) x)' is a continuation and can be called 'k'. Also, '+c' function takes continuation as parameter(CPS), And instead of returning a value, the call of function 'k' is returned as a result.

   Reference)
   https://www.youtube.com/watch?v=2GfFlfToBCo
   https://www2.cs.sfu.ca/CourseCentral/383/tjd/racket_cps.html

4. (3 points) Recently, continuation is adopted in Java JDK. Please watch the following YouTube video about it.
   Why continuations are coming to Java:
   https://www.youtube.com/watch?v=9vupFNsND6o
   Then, answer/discuss the following questions (**in one page full, more than 500 words**)
   a. After watching the video, what were the major issues adopting continuations in Java JDK as you think?
      Ans)
      First, it is to implement the thread of the JDK in user mode that does not go to the kernel. The second is to implement a lightweight thread.

   b. Discuss and explain why Oracle wanted to adopt continuations in Java JDK?
      Ans)
      First, the stack is part of a continuation. Therefore, it can pass some information from run to yield. Also, serializable is possible through continumation. Thus, using this low-level construct, it can create scalable threads that are lightweight, clear, easy to maintain, easy to debug more than threads provided by the kernel.

   c. Discuss why adding new features such as continuations and first-class functions in the existing languages is important and what could be the pros and cons in general.
      Ans)
      By adding things like continuation and first-class function, it is possible to efficiently deal with the inefficient parts of the existing language. It is also important to add new features to implement new functions. In addition, functional languages have the advantage of guaranteeing stability when implementing threads because memory does not change.
      The disadvantages is that the more new features are added, the larger the programming language becomes

What to submit

1. Create a google doc in your shared google directory for this class.
    - HW5_[Student_id]_[name]. e.g., HW5_19800179_JaechangNam

Due Date

1. 22:00, December 21 (Tue) 2021.
2. No late submission accepted.

Evaluation (Full mark: 6 points)

- 7: Answered all topics with high quality.
- 6: Answered all topics with high quality with minor issues.
- 4~5: Answered all topics with multiple issues.
- 1~3: Answered something but limited.

HW5 FAQ

If you have any questions, put your questions in the HW4 FAQ by creating a comment and tag JC(+jcnam@handong.edu) or TAs.
https://docs.google.com/document/d/1kugImvsYWFBXD5AelMrzS4lA_Rra-KpfgR3YQhq_VtM/edit