2009.06.23

NSS ICT programming module from CIT+ALCS to ICT

CHUNG Wai Tung

Background

- 2009-2012 First NSS ICT implementation
- **CIT Module A + ALCS Paper 2 = ICT Module D** *(Software Development)*
- Main focus of ICT Module D
  (1) programming, algorithms and data structure 47 hours (CIT level + ALCS level / 2)
  (2) programming languages and translator technologies 12 hours (ALCS level)
  (3) system development - software development cycles 16 hours (ALCS level)

Major **objectives** of teaching programming in HK secondary schools

- ICT exam
- Write real programs
- Join HKOI / CCC / NOI / IOI / ACM programming competitions
- Bridging for U-level IT-related subjects professional training

Quick scan – programming I

- Top-down, bottom-up, stepwise refinement, modularity, structured programming, structured data types, user-defined data types, **set**, flowcharts, block diagrams, counting, accumulating, swapping, searching, sorting, merging, linear search, binary search, bubble sort, insertion sort, **merge sort**, merge two arrays, **realize quick sort**

old ALCS syllabus only more attention

Quick scan – programming II

- **Complexities**, data structures, efficiency, correctness, appropriateness, global variables, local variables, parameters passing, **call by value**, **call by reference**, precedence and association, sequence, selection, iteration, **recursion**, lists, stacks, queues, **linear linked lists** in terms of arrays, **binary tree**, text file **updating**, syntax/logical/runtime errors, rounding/truncation/overflow/underflow errors, stubs, flags, break point

old ALCS syllabus only more attention

Quick scan – programming languages

- Procedural, logic, object-oriented, query languages, selection criteria, compilers, interpreters, code generation, linkers, loaders, **lexical analyzer, parser, semantic analysis, syntactic analysis, symbol table, token strings, parse trees, object program**

old ALCS syllabus only more attention

Quick scan – system developments I

- Environment, inputs, outputs, processes, interfaces, storage, **Waterfall Model**, gather information, interviews, surveys, questionnaires, observations, document review, **users' requirements**, **feasibility study**, **proposed solution**, **PERT chart**, **Data Flow Diagram**, **test plan**

old ALCS syllabus only more attention

Quick scan – system developments II

- System **conversion**, pilot / phased / parallel / direct cutover, **ongoing maintenance**, upgrading, training, system documentation, **technical documentation**, user manuals, requirement statements, project plans, design plans, **prototyping**, **RAD**, **job titles**

old ALCS syllabus only more attention

Choose an appropriate algorithm for a task : searching, merging, sorting, recursion, etc.

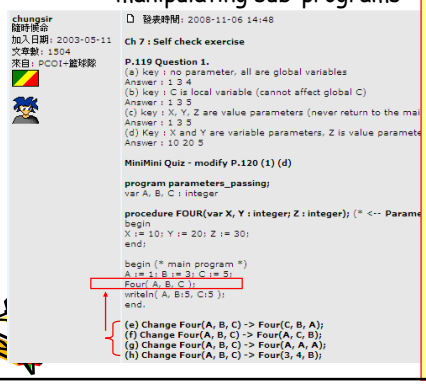
- A kind of application skill
- Task-oriented
- Problem-based learning

ID	Problem name
1000	Helloworld
1001	A+B Problem
1002	Quirksome square
1003	Hangman Judge
1004	Manok Mark
1005	Bridge
1007	Bitmap - Hexagon
1008	The Lottery
1009	Magic Square
1010	Sum of multiples
1011	Prime factors

Time complexity – Big-O

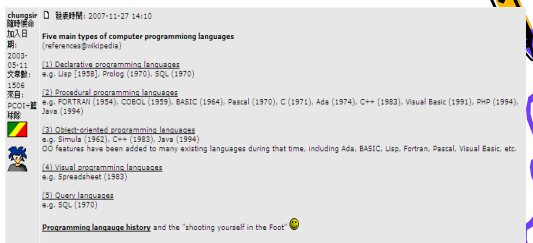
Notation	Name	Example
$\mathcal{O}(1)$	constant	Determining if a number is even or odd
$\mathcal{O}(\alpha(n))$	inverse Ackermann	Amortized time per operation when using a disjoint-set (union-find) data structure
$\mathcal{O}(\log^* n)$	iterated logarithmic	The `find` algorithm of Hopcroft and Ullman on a disjoint set
$\mathcal{O}(\log n)$	logarithmic	Finding an item in a sorted list with the binary search algorithm
$\mathcal{O}((\log n)^c)$	polylogarithmic	Deciding if n is prime with the AKS primality test
$\mathcal{O}(n^c), 0 < c < 1$	fractional power	searching in a kd-tree
$\mathcal{O}(n)$	linear	Finding an item in an unsorted list
$\mathcal{O}(n \log n)$	linearithmic, loglinear, or quasilinear	Sorting a list with heapsort, computing a FFT
$\mathcal{O}(n^2)$	quadratic	Sorting a list with insertion sort, computing a DFT
$\mathcal{O}(n^c), c > 1$	polynomial, sometimes called algebraic	Finding the shortest path on a weighted digraph with the Floyd-Warshall algorithm
$\mathcal{O}(c^n)$	exponential, sometimes called geometric	Finding the (exact) solution to the traveling salesman problem (under the assumption that $P \neq NP$)
$\mathcal{O}(n!)$	factorial, sometimes called combinatorial	Determining if two logical statements are equivalent [1], traveling salesman problem, or any other NP-complete problem via brute-force search

Implement parameters passing in manipulating sub-programs



(d) Answer
10 20 5
(e) Answer
1 20 10
(f) Answer
10 3 20
(g) Answer
20 3 5
(h) error : variable expected

Choose a programming language



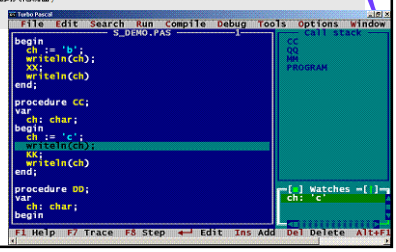
http://210.176.23.163/course/computer/public_html/(AL)%20Program%20Tracing%20(Prolog,%20C++,%20SQL)/

program debugging

TP70之寶：TURBO DEBUGGER

- 大家若果要處理比較艱深的問題，必須要開始使用debugger，TP70最好用的地方，是它有一個非常user friendly的debugger。

- **CTRL-F7** ADD WATCH (加入被監視數據)
- **F8** STEP-BY-STEP (一句一句執行)
- **CTRL-F2** RESET EXECUTION (由頭再行過)
- **ALT-W, TILE** (把所有視窗同時顯示)
- **F6** SWITCH BETWEEN WINDOWS (跳到其他視窗)
- **CTRL-break** (用戶提出中止執行)



Case studies : PCOI and ICT programming

- Automatic program judge website
  (1) school-level
  (2) interschool-level
- Everyone can contribute
- Study **Logs** for further references
- Problem-based **24x7** self learning

[Home | Task | Submit | Status | User list | User info | Statistic | Logout (wtchung)]

Task

Sorted By AC

Search:

Solved | Unsolved | All | AC

ID	Problem name	Start date	Time limit	Status	Submit	Sol
1000	Helloworld	2006-07-26	1 s	289	Go	
1030	Fibonacci sequence	2007-04-21	1 s	163	Go	
1009	Magic Square	2006-08-04	1 s	161	Go	
1017	Area and Perimeter	2006-08-07	1 s	159	Go	
1011	Prime factors	2006-08-06	10 s	150	Go	
1085	Pascal triangle	2007-05-08	1 s	150	Go	
1024	Climbing Worm	2006-08-11	1 s	142	Go	
1026	3 Cups	2006-08-11	1 s	136	Go	
1018	Pass or Fail	2006-08-07	1 s	133	Go	
1007	Bitmap - Hexagon	2006-08-04	1 s	125	Go	
1071	Serial numbers	2006-12-08	1 s	118	Go	

Beginner's level

1025	The God of Moon	2006-12-14	1 s	10	Go	
1076	Wireless Communication	2006-12-10	1 s	10	Go	
1102	Sorting game	2008-10-20	1 s	10	Go	
1036	Paper-Scissors-Rock	2006-08-28	1 s	9	Go	
1048	Course Allocations	2006-10-22	1 s	8	Go	
1073	CIT exam uses Procedures ...	2006-12-09	1 s	8	Go	
1082	Nonomino Sudoku	2007-02-12	1 s	8	Go	
1072	Binary search tree and its depth	2006-12-08	1 s	7	Go	
1078	High Table Dinner	2006-12-12	1 s	7	Go	
1047	Number Line				Go	
1083	Save your grandma	2006-12-08	2 s	6	Go	
1064	Carrying Laser Cannons	2006-12-01	5 s	5	Go	
1062	Wall game	2006-12-01	1 s	4	Go	
1069	Marathon	2006-12-05	1 s	2	Go	
1034	find -st /	2006-08-25	1 s	1	Go	
1070	Simple Matrix Calculation	2006-12-05	3 s	1	Go	

Advanced level

Problem status - Wall game

Problem ID	1062
Problem name	Wall game
Solved	4
Accepted	4
Prestation error	0
Wrong answer	45
Runtime error	0
Time limit exceeded	0
Output limit exceeded	0
Compile error	2
System error	0

Solved user list

hkho gary those mhhon

Status

Problem ID	User ID	Submit time	Language	Status
1062	pyso	2008-07-15 01:32:30	Pascal	Wrong Answer
1062	pyso	2008-07-15 01:23:14	Pascal	Wrong Answer
1062	pyso	2008-07-14 16:52:00	Pascal	Wrong Answer
1062	pyso	2008-07-14 16:50:29	Pascal	Wrong Answer
1062	pyso	2008-07-14 16:49:58	Pascal	Compile Error
1062	pyso	2008-07-14 16:37:45	Pascal	Wrong Answer
1062	pyso	2008-07-14 16:32:48	Pascal	Wrong Answer
1062	pyso	2008-07-14 16:06:19	Pascal	Wrong Answer
1062	mhhon	2008-07-14 16:02:40	C++	Accepted

[Home | Task | Submit | Status | User list | User info | Statistic | Logout (wtchung)]

Problem 1062 user mhhon

When you have submitted a correct solution, you can check for others answer!

ALCS student

User ID	Solved	User ID	Solved	User ID	Solved
whlaw	62	kyto	26	kin	19
koe	57	lawrencelee	26	Thomas	19
PedroFok	43	khman	24	winterdesire	15
hmfong	38	tohubohu	22	yp_wong	13
htlam	34	OhSze	22	20021125	12
shingingstar	33	chchoi	20	louis	12
utchan	33	Fung	20	Elaine	6
wwy	32	kktyhk	19		
wave	30	tanpopo	19		

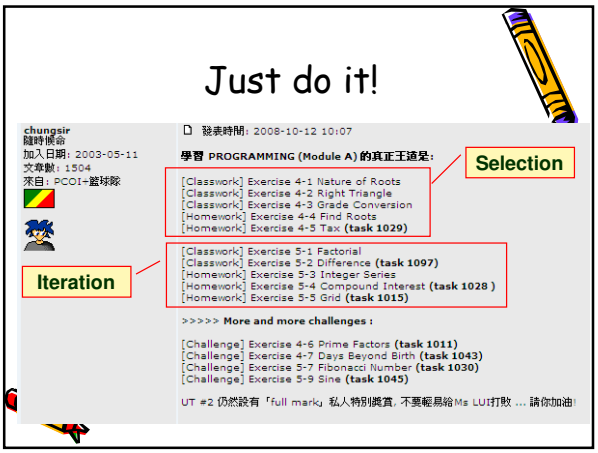
Trainer

User ID	Solved	User ID	Solved	User ID	Solved
gary	60	hkho	17	mkleung	0
those	58	billynyh	8	genya	0
iceki	56	billy	2		
sunny	33	pc-mhh	1		
wtchung	25	macau	1		

Macau PCMS

User ID	Solved	User ID	Solved	User ID	Solved
ryan_oda_pcms	21	002_mo	2	005_mo	1
natalie_pcms	12	007_mo	2	lnam_mo	1
keilapcms	10	max_pcms	2	chin_mo	1
mypcms	9	harrypcms	2	adapcms	1
lwcpcms	7	006_mo	2	athenapcms	1
stevenpcms	6	010_mo	2	008_mo	1

Just do it!



Just do it!

All in one

分組之後的新一輪 on line judge 題目 :

[Challenge] Exercise 4-6 Prime Factors **(task 1011)**
[Classwork] Modify EG7-04.pas to add CalculateTax() **(task 1073)**
[Homework] Exercise 6-2 Bank Payment Calculation **(task 1028)**

繼續做「數學化」的2-D array題目:

(1) 完成**ex8-1 pascal trianlge (task 1085)** 之後可以繼續做 :
- task 1098 Square (format tester) **(2-D array)**
- task 1009 Magic Square **(2-D array)** (若果你沒有頭緒, 可以參考我的示範)

Arrays manipulation

Just do it!

String processing

由於今天有幾位4F的同學公假, 請大家今天晚上自行完成第9課 string processing 功課:

[Classwork] Exercise 9-1 Date Format
[Classwork] Exercise 9-2 Initial of Name <-
[Homework] Exercise 9-3 Password <-- 輸入20個字符計算密碼
[Homework] Exercise 9-4 Grade Point <-- 會考計分
[Homework] Exercise 9-5 Roman Numerals (task 1087)

[Judge] task 1071 Serial numbers
[Judge] task 1086 Creating email accounts
[Judge] task 1100 Spy (Episode 1)

online judge ch 10 的相關題目 :

task 1103 We love BUBBLE sort! <-- Easy job!
task 1014 Medal <-- multiple keys sorting
task 1102 Sorting game <-- bubble sort is NOT fast enough to solve the last 5 sets of data (TLE error), you must use sorting algorithms of O(n log n) to solve this problem, such as QUICKSORT or HEAPSORT!)

Sorting

Useful open resources from the Pui Ching Team

- Pascal learning web & Program tracing : http://resource.puiching.edu.hk/computer/
- Computer discussion forum : http://student.puiching.edu.hk/viewforum.php?forum=3
- [cit] 08-09 中四電腦課 重要資料
- [alcs] ALCS 2009 Chungsir Class

Demonstration Time ~ Thank you!