STOCHASTIC MODELING AND CONCURRENT SIMULATION OF THE GAME OF GOLF

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To appear in ETRI Journal

Short Bio

- BS & MS at KAIST (’91 & ’95)
  - Specialty : Video Coding & Signal Processing
  - Military Service (’92-’93)
- PhD at Univ. of Michigan, Ann Arbor (’00 Sept.)
  - Thesis : Resource Allocation in Wireless Networks
- Ericsson CDMA Systems (’00 Sept.-’03 Mar.)
  - HDR (DO) base station design
  - 3GPP2 Ericsson Representative (Physical Layer)
- Qualcomm CDMA Technologies (’03 Mar.-’07 Aug.)
  - System Engineer for modem (ASIC) design
  - Chipset designed - CSM 6700, MSM xxxx
- Korea University (‘07 Sept.-)

Motivation

- Need a publication
  - What problem to solve ?
- But, I still love GOLF
  - Problem in my Golf ?
  - Have been frustrated in the outing
  - Excuses for my poor play are needed !!!
    - ***I have waited (in the rounding) too much due to the shot-gun play format***

Feasibility Issue

- Ethically, am I allowed to write a paper about Golf ?

- But … there are many examples of (ethically) questionable research
  - Quantum physics
  - Gambling theories
  - Decision theories
  - Financial data analysis

About the Research

- 서남표 KAIST 총장님의 글
  - (조선일보 2009년10월13일) “잠시만 기다리자, 노벨상 받는날” 이라는 글중에서, 어떤 사람이 노벨상을 받는가에 대해서
  - … 일반적으로 연구의 목적을 노벨상 수상에 둔 사람보다는 자신의 일에 애정과 열정을 갖고, 근본적이고 창조적인 생각을 가지고 지식을 추구하며 그들의 일생을 헌신한 사람들이 이 상을 받을 가능성이 높다. 즉, 노벨상은 ***자신이 흥미를 느끼는 분야에서 중요하다고 생각되는 문제*** 를 풀기 위해 최선을 다한 과학-기술자들의 몫이다…

The Real Problem "Regular vs. Shotgun"

- Regular format
  - Tee times are 6:30 AM, 6:38AM, … separate by 8 min.
  - Different starting times
    - Not good for the big outing

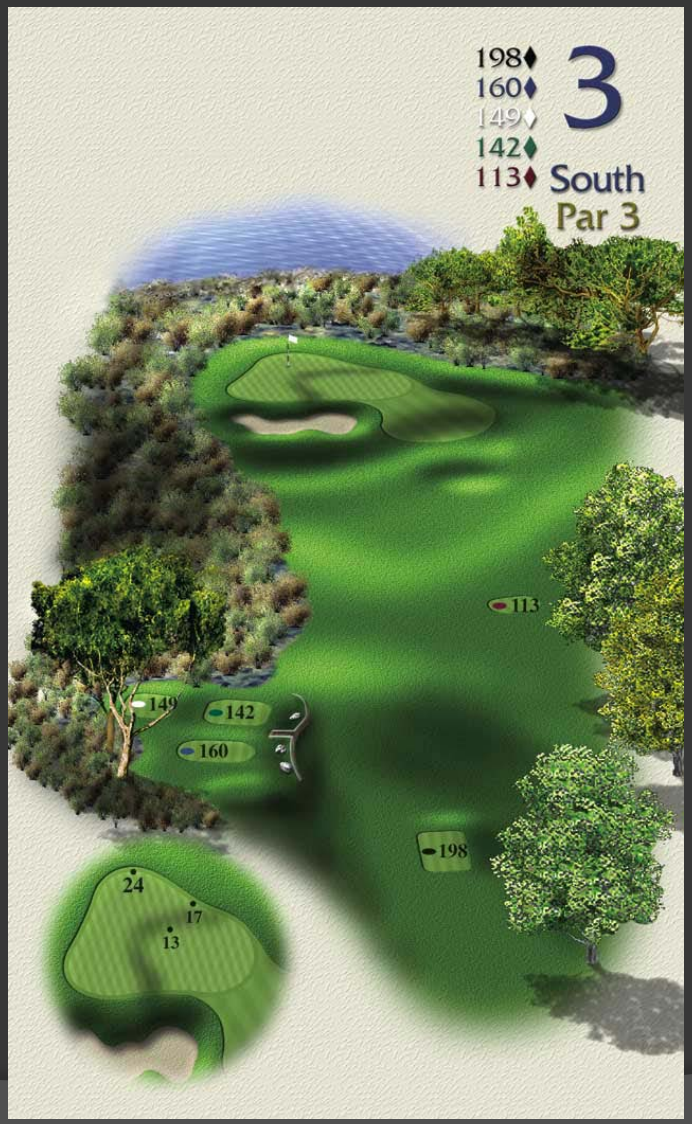
- Shotgun (Circular) format
  - Every group starts at the same time
    - Group 1-A from Hole 1-18, Group 1-B follows 1-A … …Group 7-A from Hole 7-18 then Hole 1-6 holes
  - Common in popular US golf course, especially on Saturday
  - Good
    - the big outing
    - the resource usage
    - Golden tee time for many
  - BUT… BIG Delay !!!

Torrey Pines Golf Courses

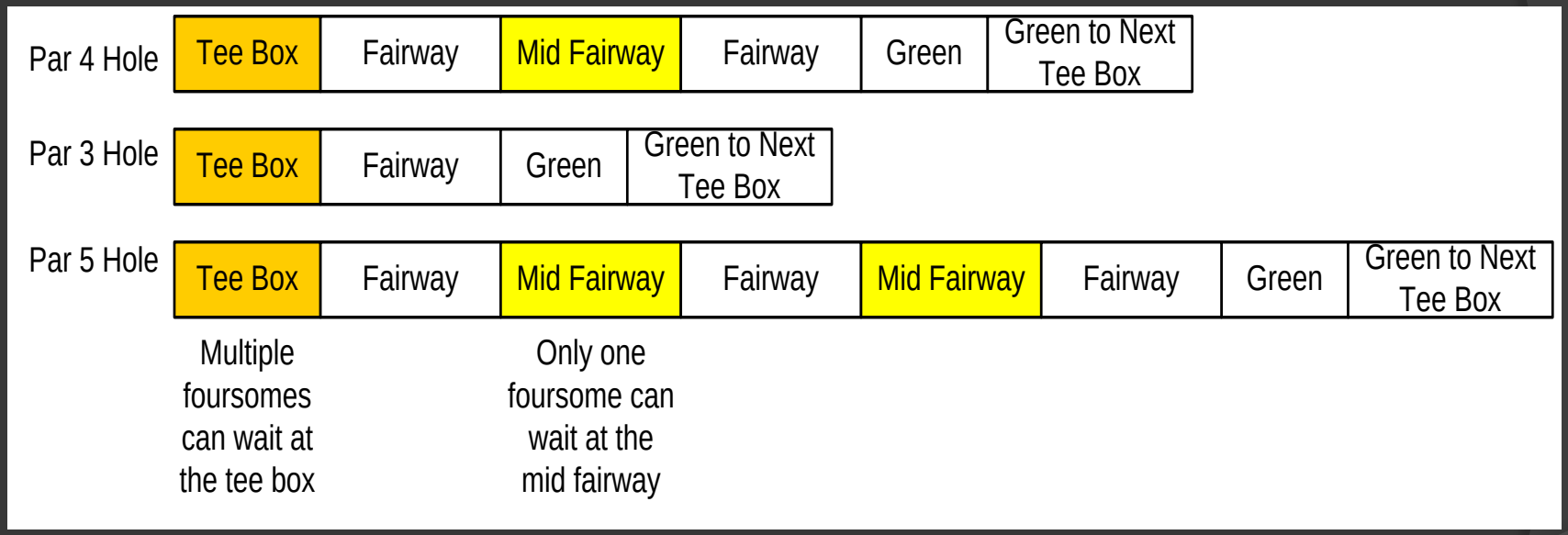
How is the Golf being played

- Typically foursome
- 18-holes
- Tee-Shot then followed by (green-) approach shot
- Shot, Walk, Find and **Wait**

Par-3 & Par-5 Holes

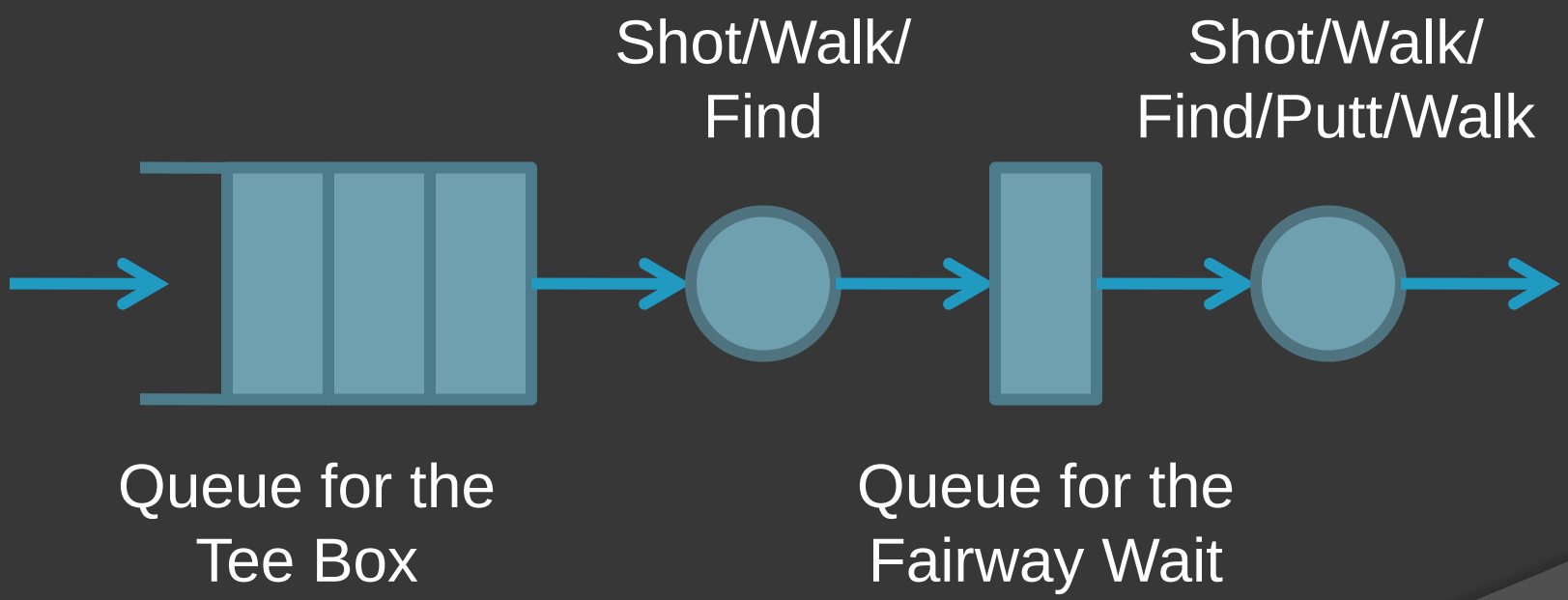


Resource Model

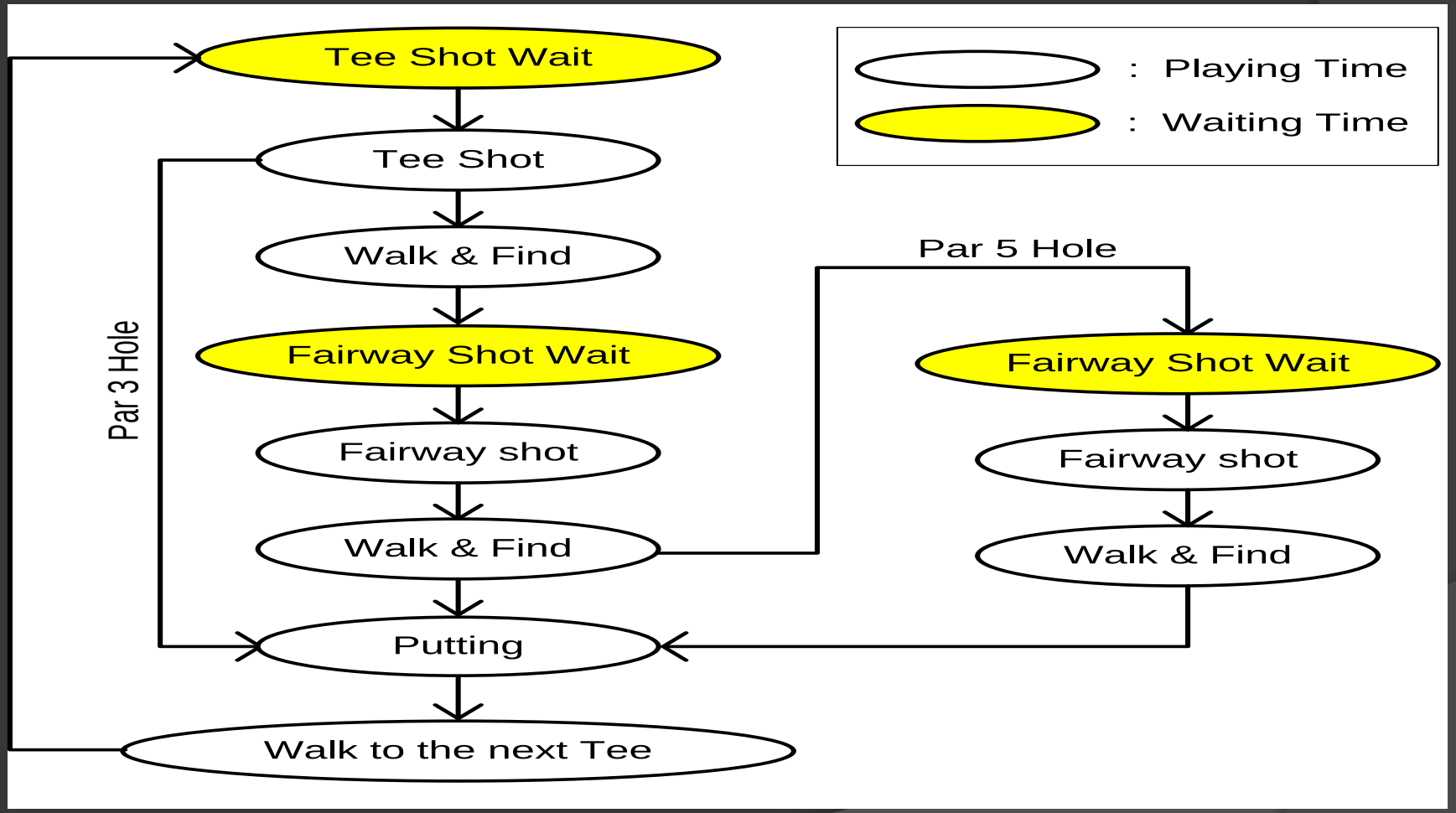


Queueing Model

- Tandem Queue for a Par-4 hole



Finite State Machine



What to do with this ?

- Analysis
  - Basically, impossible
- Simulation
  - Can be done … but a new paradigm

CSM 6700

- For 1x Base Station up to rev. D. (IS-95 also) of cdma2000 standard
- State-of-the-art modem technology ~ 2005
- 175 million transistors
  - Verification becomes the most critical issue

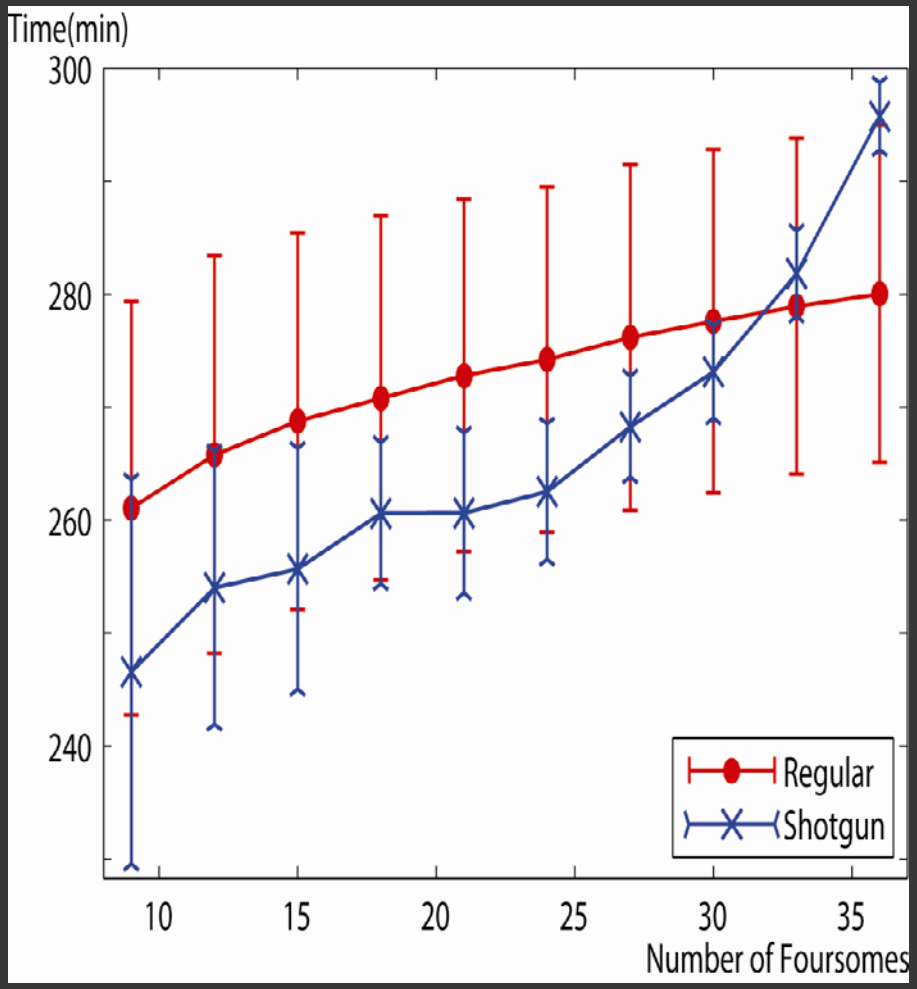
SystemC

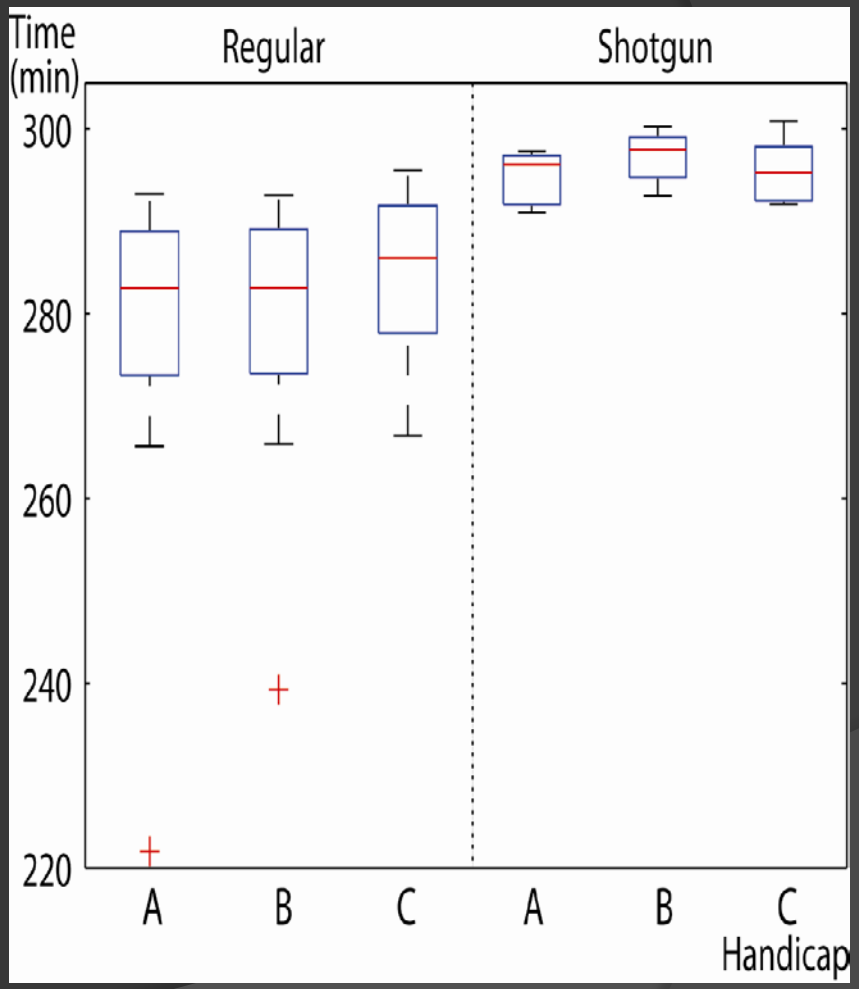
- (Free) C++ library
- Concurrent Simulation with C-syntax
- Originally designed as a VHDL/Verilog replacement
- Can be used for the ASIC functional verification purpose

Write a paper

- Behavior of foursomes in a Golf game is modeled by a finite-state machine
  - Coupling between foursome is realistically modeled
- Concurrent Simulation by SystemC
- Justify the intuition
  - Shot-gun is worse if the number of foursomes exceeds 33

Results


Time(min)
300
280
260
240
10
15
20
25
30
35
Number of Foursomes
Regular
Shotgun


Time
(min)
Regular
Shotgun
300
280
260
240
220
A
B
C
A
B
C
Handicap

Issues before the submission

- Can this be an academic paper ?
  - Not an academic motivation
  - No strong mathematical rigor
  - Reputation …
- Where to submit ?
  - No SCI journal in the sport management ?
  - Very minimal references

From Submission to Acceptance

- Rejected, firstly
  - Surprisingly… because of the missing the recent related publications
  - Strongly encouraged
    - Original submission did not emphasize the Golf … socio-cultural
- Accepted after the re-submission and the revision
  - Make a connection with IT was a bit tough

Some comments from colleagues

- About the closed queue
  - from Prof. Eun Do-Young (NC State Univ.)
- The magic number 22
  - from Dr. Kim Joonyoung of Intel

Future Work

- Real Data
- Vehicular Traffic Analysis using SystemC