

Singapore Institute of Management
BSc in Computing & Information Systems
CIS 210 Revision Test
September 2002

1. The Singapore Football League has 10 teams, each with own stadium. Every Sunday at 2pm, each team will play in a match. The schedule is such that for 9 weeks each team plays against a different one, alternating home games (which are games played in own stadium) with away games (which are played in the opponent's stadium).

At the end of the 9 weeks, the schedule is repeated, such that the teams meet for a second time in the other stadiums. Each team plays all other teams twice in the 18-week season, once at home and once away.

Each team has 22 players which it can choose from, but only 11 play at any 1 time. Before each game, the team's coach chooses the initial 11 players and 6 substitutes. Note that at most 3 substitutes may be made during a game. Each substitution consists of replacing one of the current players in the field with one of the substitutes.

When a player displays very bad conduct, the player may be sent off during the game. In this case, no substitution may be made.

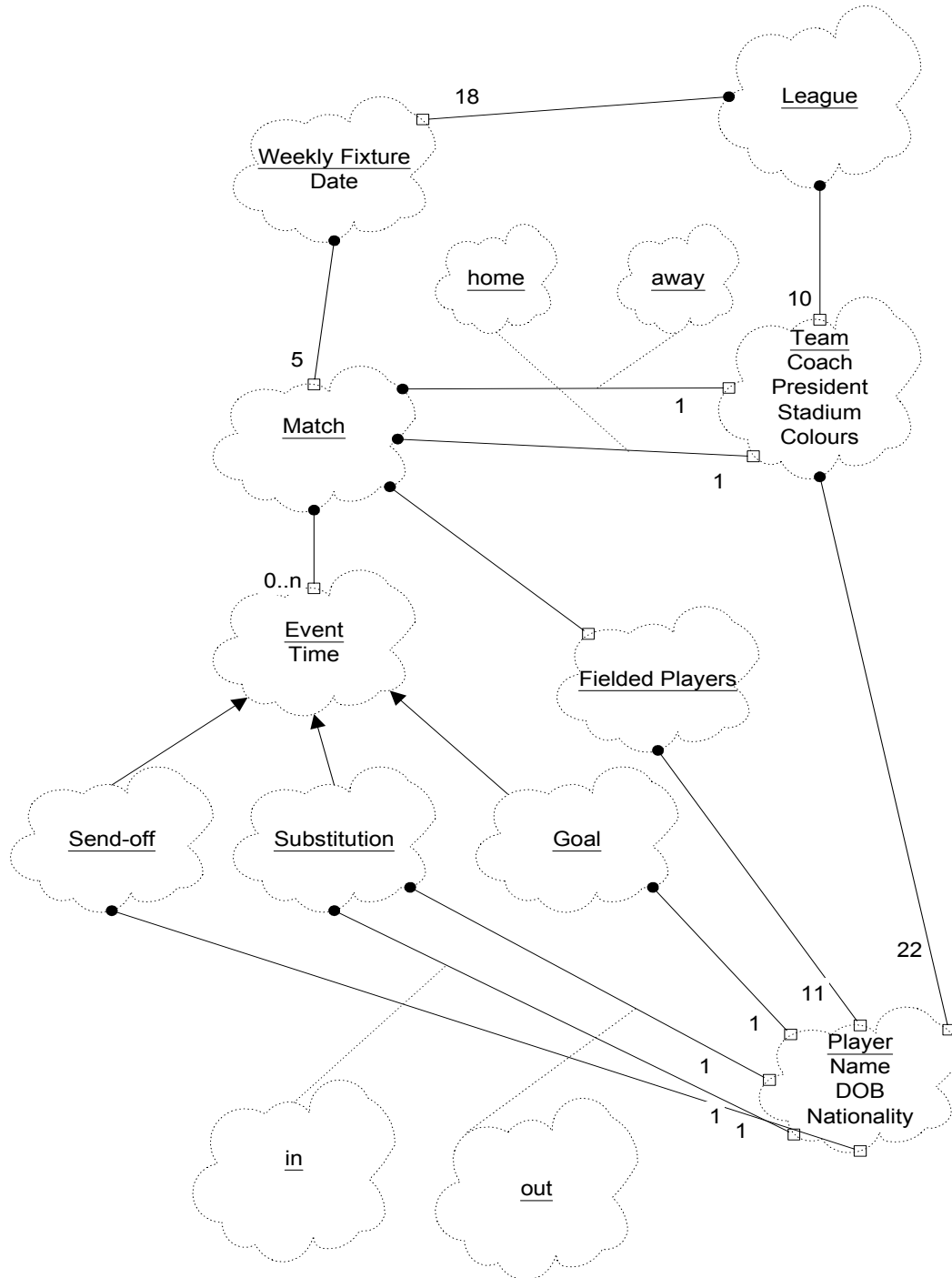
Each of the players may score any number of goals during the game. Note that some players may be unfortunate to score a goal to the opponent's advantage.

At the end of the game, the winning team gains 3 points in the overall classification, while the other team receives 0 points. When there is a draw, each team is awarded 1 point. These points are accumulated each week after a match, giving the point totals for the teams. The team with the highest point total at the end of the season, wins the championship.

For each game, the system must be able to store all relevant information for queries, such as

- the players who took part
- events such as goals, substitutions and send-offs
- Information about the enrolled players
- Teams (such as their president, coach, stadium, stadium capacity etc)
- Games that took place and results of the games
- Scorers in the league (e.g. number of goals scored)
- Schedule of future games
- Championship position

Draw a booch diagram, identifying the objects, and the relationships among the objects. [15 marks]



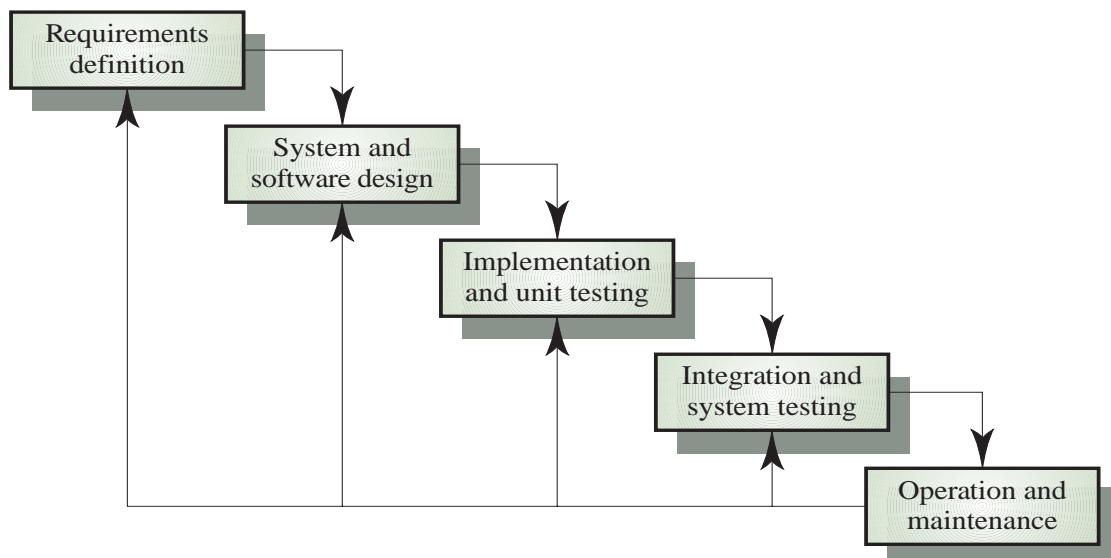
2. a) Describe the waterfall model and the spiral model. Your answer should include a diagrammatic depiction of each of the two software development methods. [15 marks]
- b) Describe the properties of a project for which the waterfall model is most suited. [5 marks]
- c) Describe the properties of a project for which the spiral model is most suited. [5 marks]

Answer:

a)

Waterfall model

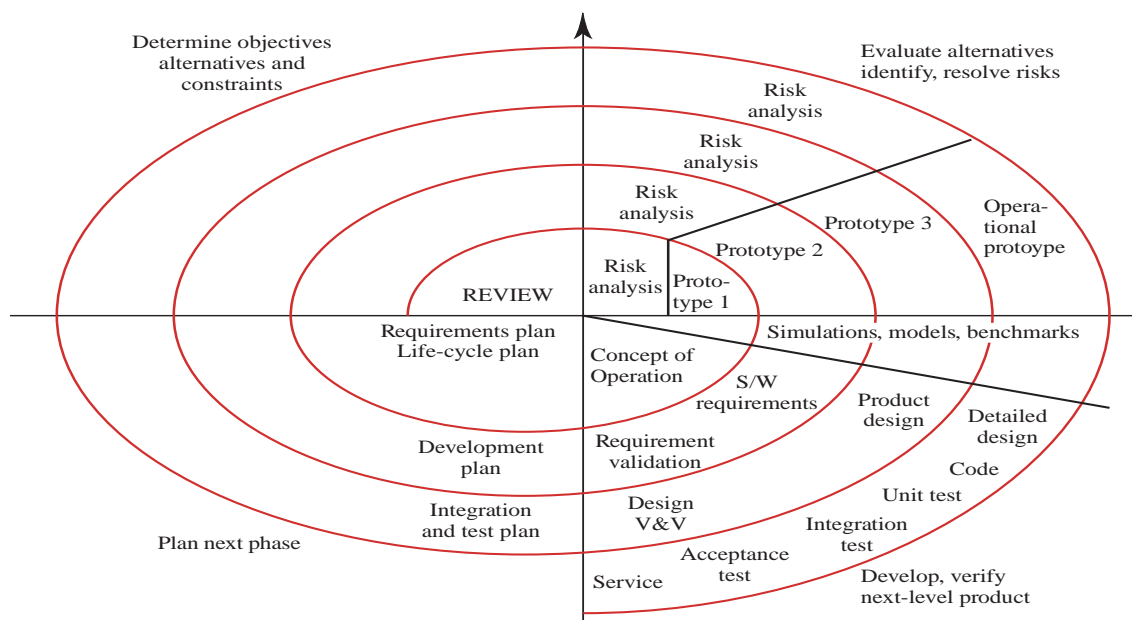
- a. Consists of the following stages – requirements engineering and analysis, design, coding, testing and maintenance.
- b. During engineering, mainly to gather requirements and document the requirements as requirements specifications
- c. Normally stages overlap and feed info to each other. Tendency for iterations of the development activities. But frequent iterations makes it difficult for reporting and planning. Tendency to delay problems to later stage for resolution resulting in system not doing what the user wants and is unusable.
- d. Include a brief description of each phase



Spiral model

- a. Consists of the following stages – planning, risk analysis, engineering and customer evaluation

- b. An iterative software development method that makes a virtue out of the necessity to repeat stages in the software development life cycle
- c. Using this method, it is acceptable not to have complete and accurate user requirement
- d. Progress is reviewed periodically. Risk analysis is employed to decide whether or not to proceed with development
- e. Include brief description of each phase



b) *Waterfall Model*

- a. Projects where requirements is well known and can be gathered and documented up-front
- b. Need to be visible and identify deliverables and progress
- c. Stable requirements

c) *Spiral Model*

- a. Suited in situations where requirements are not well understood
- b. Gives ability to opt out of project should the risk analysis indicates that the project has become unattractive

3. Below is a procedure P written in Pascal-like pseudocode. The procedure inputs 100 pairs of integers (a,b) and counts the number of pairs satisfying condition (a<=10 AND b>2) and the number of pairs that do not satisfy the above condition.

a) Build a control flow graph for procedure P and compute its cyclomatic complexity [5 marks]

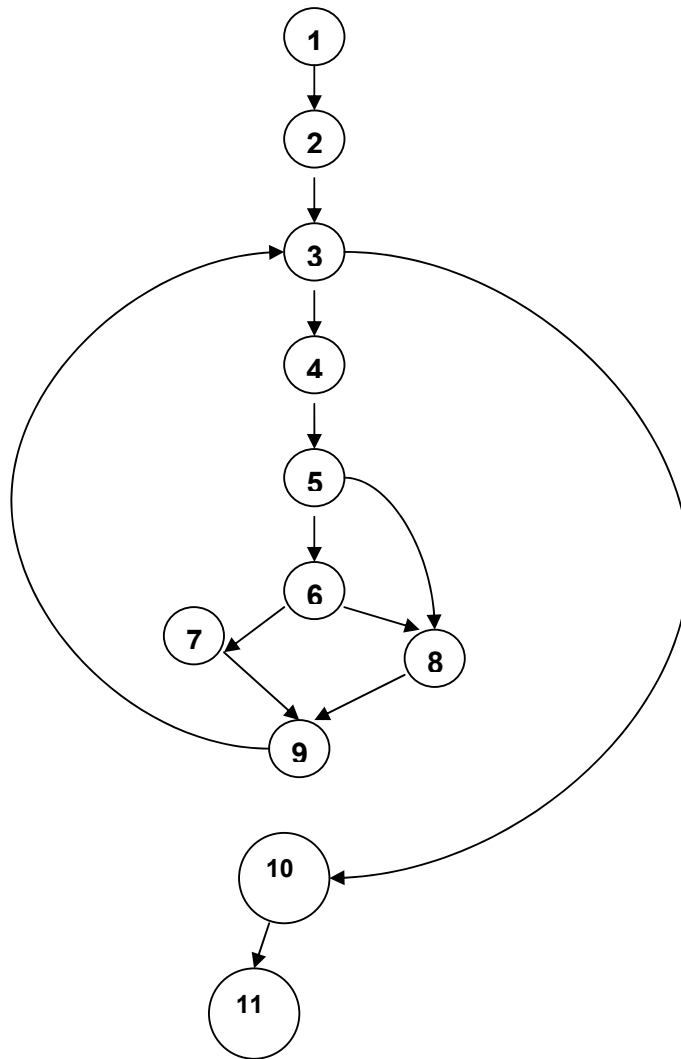
```
procedure P
    a,b,x,y : integer;
    x:=0; y:=0;
    for i:=1 to 100 do
    begin
        read (a,b)
        if (a<=10 AND b>2)
            x:=x+1
        else
            y:=y+1
        endif
    endfor
    print (x,y)
end P
```

b) Find a basis set of independent paths in a control graph of procedure P. [5 marks]

Answer:

x:=0	[statement 1]
y:=0	[statement 2]
for i:=1 to 100 do	[statement 3]
read (a,b)	[statement 4]
if (a<=10 AND b>2)	[statement 5, 6]
x:=x+1	[statement 7]
y:=y+1	[statement 8]
endfor	[statement 9]
print (x,y)	[statement 10]
end P	[statement 11]

V(G) = 4



- path 1: 1-2-3-10-11
- path 2: 1-2-3-4-5-6-8-9-3...-10-11
- path 3: 1-2-3-4-5-8-9-3-...-10-11
- path 4: 1-2-3-4-5-6-7-9-3-...-10-11