

EE4001 / IM2001

NANYANG TECHNOLOGICAL UNIVERSITY
SEMESTER 1 EXAMINATION 2014-2015
EE4001 / IM2001 – SOFTWARE ENGINEERING

November / December 2014

Time Allowed: 2 hours

INSTRUCTIONS

1. This paper contains 4 questions and comprises 5 pages.
 2. Answer ALL questions.
 3. All questions carry equal marks.
 4. This is a closed-book examination.
-

1. (a) Name the four basic concepts in the data flow diagram (DFD) technique. Identify the most suitable basic concept in the DFD technique to model each following item:

- (i) Estimate cost for software project.
- (ii) A request of cash withdrawal.
- (iii) All customers' particulars.
- (iv) An external system receives inputs from the target system.

(6 Marks)

- (b) Draw a state diagram to model the following behavior of a customer order:

When a customer places an order with the company, the order will be created. Then, it will be processed. If the products ordered are fully available, the products will be delivered to the customer and the order will be fulfilled. If some of the products ordered are partially available, then nothing will be delivered and the order will be outstanding. Subsequently, when the products ordered in an outstanding order become fully available, the products will be delivered and the outstanding order will be fulfilled. Each fulfilled order will be billed by sending an invoice to the customer. It will also be updated as closed.

(6 Marks)

Note: Question No. 1 continues on page 2.

EE4001 / IM2001

- (c) Draw a class diagram to model the structural properties of the following problem:

A software company sells both products and services to customers. Products can be classified into system software and application package. All the products and services are marketed by sales executives. Each product is supported by a number of product specialists. Services can be classified into turnkey development, maintenance and facility management. All the services are organized as projects. Each project has a project team to work on it. A project team is formed by at least three staff members. One staff member from the project team, called project manager, manages the project. A staff member can be a project member of up to five projects. A project manager may manage multiple projects concurrently.

(9 Marks)

- (d) Figure 1 gives two segments of Entity Relationship (ER) diagrams. Based on the diagrams, if the number of instances of A and C are both 1000, derive the number of instances of B and D as precisely as possible.

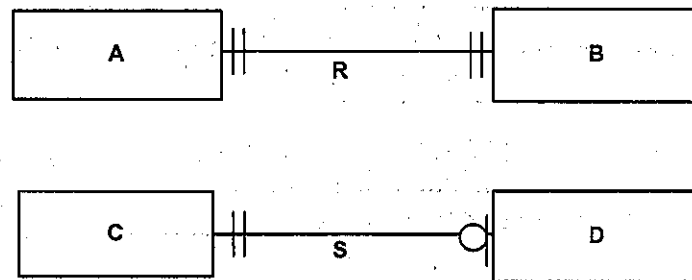


Figure 1. Two segments of ER diagram

(4 Marks)

2. (a) State the criteria for selecting waterfall model and prototyping model for developing a software project.

(6 Marks)

- (b) Input variable X to a program is an integer that must fall under one of the following ranges: $X \leq 1$; $6 \leq X \leq 13$; $X \geq 60$. Use boundary value testing technique to identify the boundary values for X.

(3 Marks)

Note: Question No. 2 continues on page 3.

EE4001 / IM2001

- (c) A program is written to compute the roots for a quadratic equation $ax^2 + bx + c = 0$ as follows:

$$x = \begin{cases} -\frac{c}{b} & \text{if } a = 0 \\ \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} & \text{if } (b^2 - 4ac) \geq 0 \text{ and } a \neq 0 \\ \text{no real root} & \text{if } (b^2 - 4ac) < 0 \end{cases}$$

The inputs to this program are a , b and c . Use cause-effect testing to design a test suite to test this program.

(6 Marks)

- (d) Identify a basis set of linearly independent paths through the Control Flow Graph (CFG) of a program shown in Figure 2, and calculate the number of paths in the following sets of paths through the CFG:

- A minimal set of paths that pass through each branch at least once.
- The set of all the paths that pass through any loop at most once.
- The set of all the paths that pass through any loop at most four times.

(10 Marks)

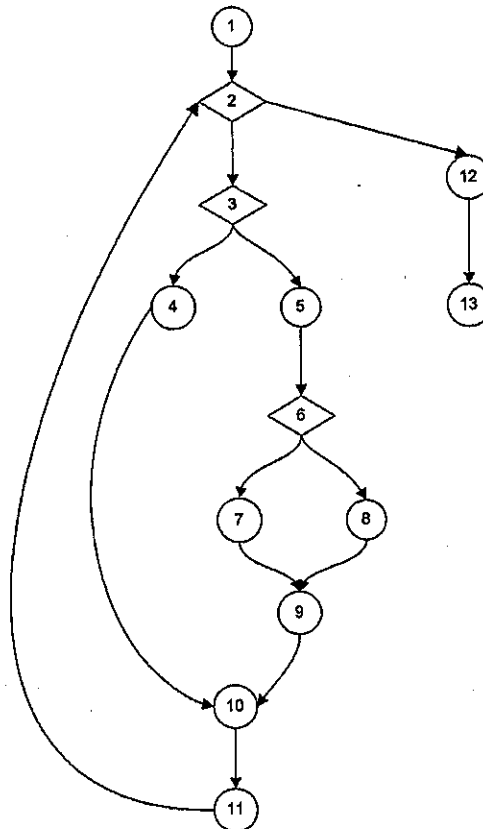


Figure 2. A control flow graph (CFG)

EE4001 / IM2001

3. (a) Project *eBook* comprises ten activities, *A* through *J*. The estimated activity duration and precedence requirements of each activity are given in Table 1. Suppose the expected completion duration is 60 days.
- Create a precedence activity network (PAN) in BS4335 using Table 1.
 - Show the rules applied for calculating the earliest start, latest finish, total float, and free float associated with each activity in the network.
 - Based on the PAN created in 3(a)(i), specify how many days activity *E* can delay without affecting the completion of the project, and how many days activity *C* can delay without affecting any other activities in the PAN.
 - Briefly explain if it is possible we do not have any critical path(s) at all in a PAN.

(15 Marks)

<i>Activity</i>	<i>Duration (days)</i>	<i>Precedents</i>
<i>A</i>	10	
<i>B</i>	10	<i>A</i>
<i>C</i>	5	<i>A</i>
<i>D</i>	15	<i>A, H</i>
<i>E</i>	5	<i>B, C</i>
<i>F</i>	15	<i>C, D</i>
<i>G</i>	5	<i>E, F</i>
<i>H</i>	5	
<i>I</i>	10	<i>F, H</i>
<i>J</i>	10	<i>G, I</i>

Table 1: The specifications

- (b) In the context of web applications (WebApp), briefly explain
- what software modeling is for.
 - the focus of each of the two levels of software modeling.
 - two types of attributes in design modeling of content objects.

(10 Marks)

EE4001 / IM2001

4. (a) The following information shows the financial status of a 20-week project at the end of the 15th week. The actual cost to date is S\$60,000. The 62.5% of the project has been completed. Suppose the budget at completion is S\$80,000. Assume that the Planned Value is linearly distributed throughout the project and the cost performance index (CPI) remains the same.

- (i) Briefly explain the key objective of Earned Value Analysis (EVA).
- (ii) Estimate the cost at completion.
- (iii) Briefly explain whether the project is on schedule. Justify your answer.

(10 Marks)

- (b) List three types of security tests in the context of web applications. Explain briefly the objectives of each type.

(9 Marks)

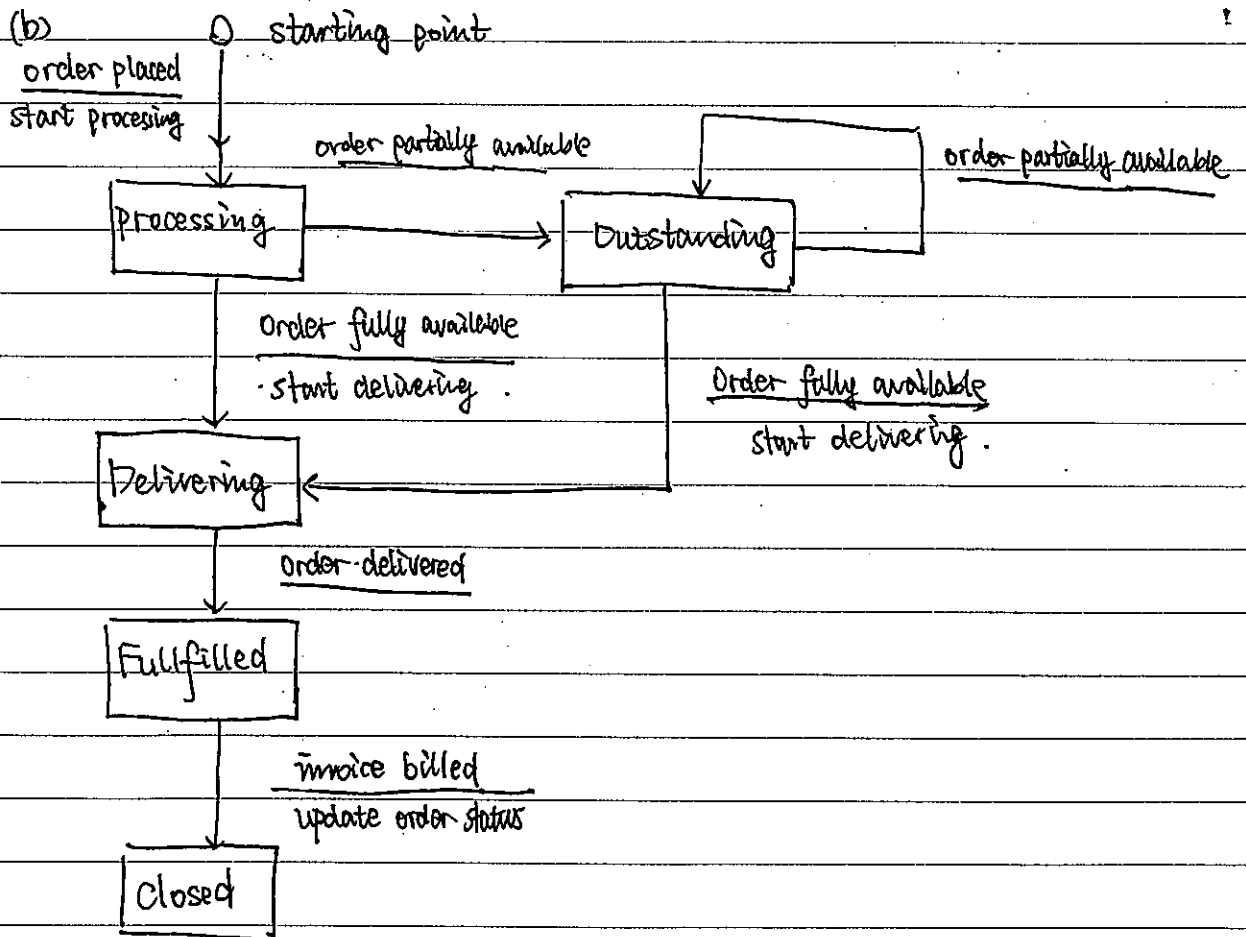
- (c) Discuss why a confident estimation is critical for the final success of software projects.

(6 Marks)

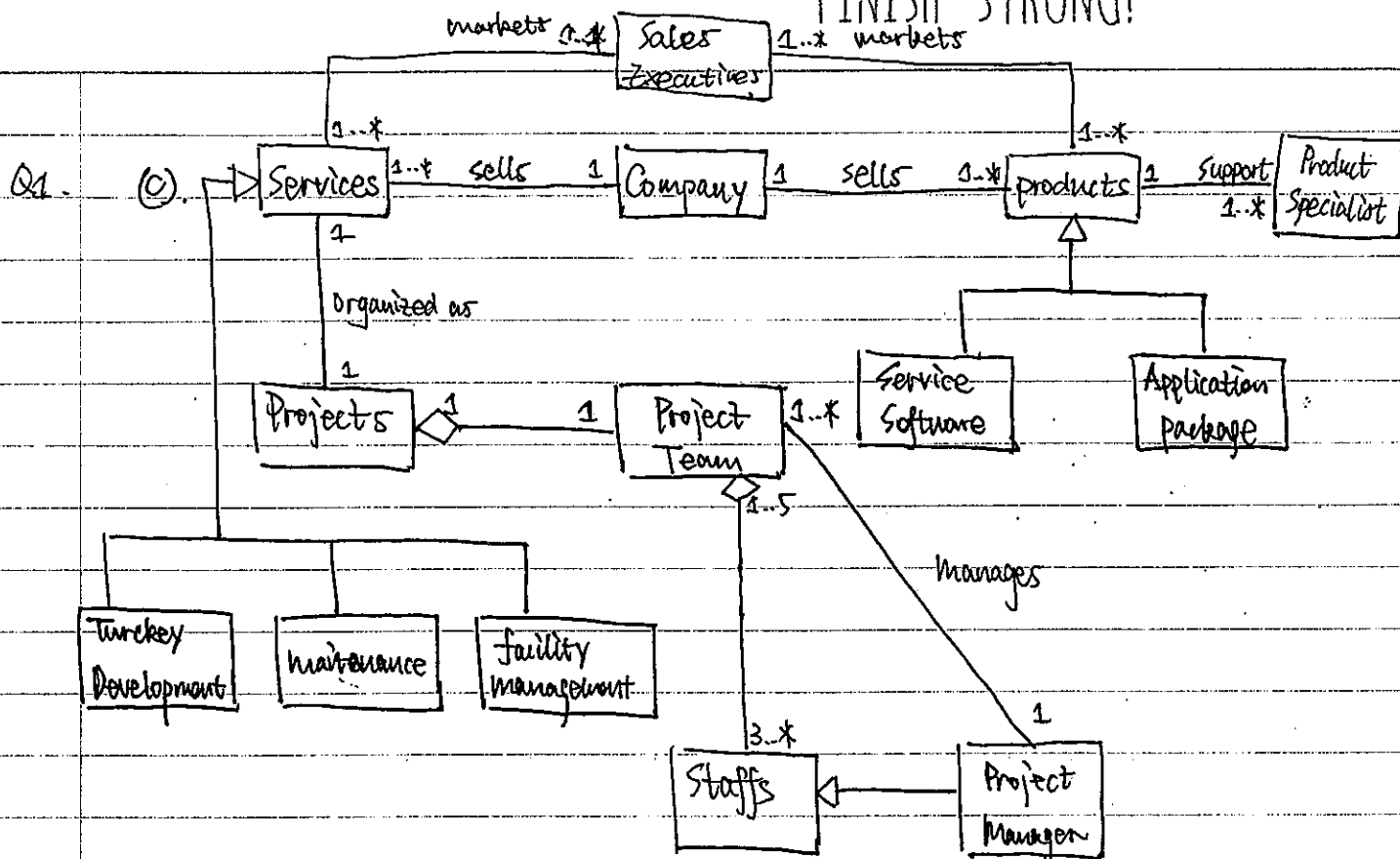
END OF PAPER

ZZ4001 14/15 S1.

- Q1. (a) (i) Data flow
(ii) Process
(iii) Data store
(iv) External Entity



FINISH STRONG!



(d). ① Since each instance of A is matched with exactly one instance of B
Number of instances of B = 1000

② Since each instance of D is matched with exactly one instance of C,
while each instance is matched with ^{how} zero or one instance of D.
Number of instance of C ≤ 1000

Q2. (a) Waterfall:

- (1) Well-defined customer requirements
- (2) Adequate Resources
- (3) Good experience on the system
- (4) System is not too large or complex
- (5) No urgent needs on delivery.

Prototyping:

- (1) Unclear requirements
- (2) Lack of experience
- (3) System is small
- (4) System is user-interface intensive.

Q2. (b). The test case can be

(1). $X=1, X=2$

(2) $X=5, X=6, X=13, X=14$

(3) $X=59, X=60$

(c).

Conditions	Rule1	Rule2	Rule3	Rule4
$a=0$	Yes	Yes	No	No
$(b^2-4ac) \geq 0$	Yes	No	Yes	No
Calculation of x	$-\frac{a}{b}$	no real root	$\frac{-b \pm \sqrt{b^2-4ac}}{2a}$	no real root

(d). (a). $V(G) = E - N + 2P = 15 - 13 + 2 = 4$

Thus the basis set of linearly independent path is

(1) $\{1, 2, 12, 13\}$

(2) $\{1, 2, 3, 4, 10, 11, 2, 12, 13\}$

(3) $\{1, 2, 3, 5, 6, 7, 9, 10, 11, 2, 12, 13\}$

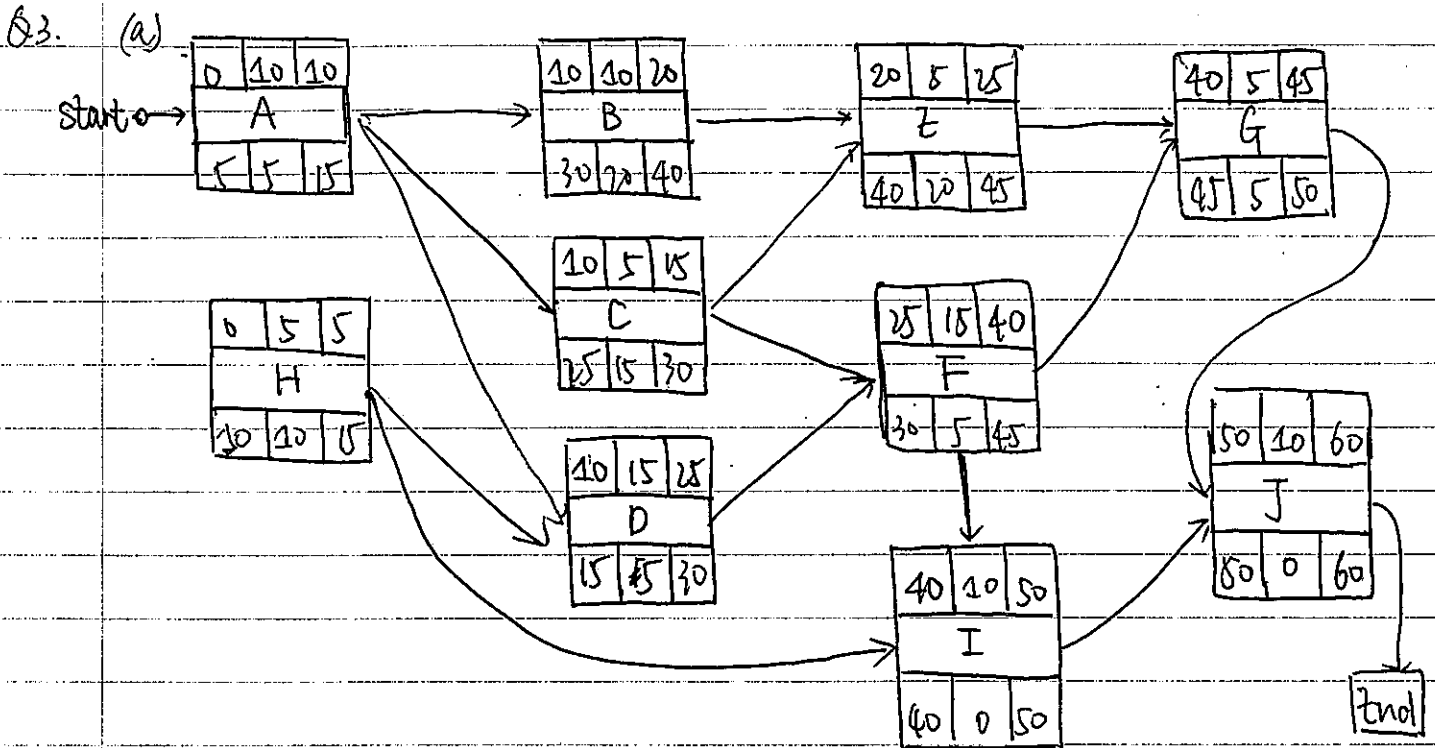
(4) $\{1, 2, 3, 5, 6, 8, 9, 10, 11, 2, 12, 13\}$

(i) $n=3$

(ii) $n=4$

(iii) $n = 4 + 3^2 + 3^3 + 3^4 = 121$

FINISH STRONG!



(iii) E delay = 20
C delay = 15

(iv) Yes it is possible, as the above graph above stated in

(b) (i) In the context of Web App, software modelling addresses specific issues related to design and development of web applications. It focus on design notations and visual languages that can finally be used for the realisation of a robust, usable Web App.

(ii) ① Analysis Modeling = to form depiction of the requirements and thus establish the basis for design of Web App.

② Design modeling: focus on providing sufficient info for the implementation of requirements.

Q3. (b) (iii) Content-specific information and implementation-specific information.

Q4. (a) (i). Key objective is to track the progress and current status of the project in terms of cost and schedule.

$$(ii). ZAC = \frac{BAC}{(ZV/AC)} = \frac{80,000}{(62.5\% \times 80,000) \div (60,000)} = \$96,000$$

$$(iii). SV = BCWP - BCWS \\ = \cancel{62.5\%} \times 80,000 \times 62.5\% - \frac{15}{20} \times 80,000 \\ = -10,000 < 0$$

Thus the project is not on schedule.

(b). Tests for

- ① Client-side Vulnerabilities
- ② vulnerabilities in the network communications
- ③ Server-side vulnerabilities.

(c). Confident estimation would provide valuable insights for the planning of software projects. It ensures a confident strategy for controlling, tracking and monitoring a complex project.

