PAPER CODE NO.
COMP207

EXAMINER : Dr. Shagufta Scanlon
DEPARTMENT : Computer Science

FIRST SEMESTER CLASS TEST (1) 2018/19

Database Development

TIME ALLOWED : 50 Minutes

INSTRUCTIONS TO CANDIDATES

NAME OF CANDIDATE .... STUDENT ID NO ....

USUAL SIGNATURE ....

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1. Consider the following two transactions (we omit the final 'commit' operation):

Transaction T_1	**Transaction T_2**
read_item(X);	read_item(Y);
X := X * 2;	Y := Y + 2;
write_item(X);	write_item(Y);
read_item(Y);	read_item(X);
Y := Y * 3;	X := X + 3;
write_item(Y);	write_item(X);
commit;	commit;

Which of the following is the correct serial schedule S_1 for $T_1 \rightarrow T_2$?

■ **A.** $S_1 : r_1(X); w_1(X); r_1(Y); w_1(Y); c_1; r_2(Y); w_2(Y); r_2(X); w_2(X); c_2$

□ **B.** $S_1 : r_1(Y); w_1(Y); r_1(X); w_1(X); c_1; r_2(X); w_2(X); r_2(Y); w_2(Y); c_2$

□ **C.** $S_1 : w_1(X); r_1(X); r_1(Y); w_1(Y); c_1; w_2(Y); r_2(Y); r_2(X); w_2(X); c_2$

□ **D.** $S_1 : w_1(Y); r_1(Y); r_1(X); w_1(X); c_1; w_2(X); r_2(X); r_2(Y); w_2(Y); c_2$

□ **E.** $S_1 : w_1(Y); r_1(Y); w_1(X); r_1(X); c_1; w_2(X); r_2(X); w_2(Y); w_2(Y); c_2$

2. Assume that the transactions T_1 and T_2 in **Question 1** use shared buffers (i.e., once a transaction writes X back to the buffer, the new value of X can be read by the other transaction, and similarly for Y).

The following is a serial schedule S_2 for $T_2 \rightarrow T_1$ for the two transactions shown in **Question 1**:

$S_2 : r_2(Y); w_2(Y); r_2(X); w_2(X); c_2; r_1(X); w_1(X); r_1(Y); w_1(Y); c_1$

For the schedule S_2, which of the following show the correct values of X and Y after executing the schedule on a database with items $X = 1$ and $Y = 2$?

□ **A.** $X = 6$ and $Y = 14$

□ **B.** $X = 5$ and $Y = 10$

■ **C.** $X = 8$ and $Y = 12$

□ **D.** $X = 7$ and $Y = 14$

□ **E.** $X = 4$ and $Y = 8$

3. Consider the following schedule S_1:

$S_1 : r_1(X); r_2(X); r_3(Y); w_1(X); r_2(Z); r_2(Y); w_2(Y); w_1(Z)$

Which of the following show the correct conflicts for this schedule?

☐ **A.** $r_1(X)$-$w_2(Y)$, $r_3(Y)$-$w_2(Y)$, $r_2(X)$-$w_1(X)$

☐ **B.** $r_1(X)$-$w_1(X)$, $r_3(Y)$-$w_2(Y)$, $r_2(Z)$-$w_1(Z)$

☐ **C.** $r_3(Y)$-$r_2(Y)$, $w_2(Y)$-$w_1(Z)$, $r_1(X)$-$w_1(X)$

☐ **D.** $r_1(X)$-$r_2(Z)$, $r_3(Y)$-$w_2(Y)$, $w_1(X)$-$w_1(Z)$

■ **E.** $r_2(X)$-$w_1(X)$, $r_3(Y)$-$w_2(Y)$, $r_2(Z)$-$w_1(Z)$

4. Consider the following conflicts in a schedule:

$r_1(X)$-$w_3(X)$, $w_1(Y)$-$r_2(Y)$, $w_2(Z)$-$r_3(Z)$

Which of the following is the correct precedence graph for a schedule with these conflicts?

(I)

$$\begin{tikzcd} \boxed{T_1} \arrow[r] & \boxed{T_2} \arrow[r] & \boxed{T_3} \end{tikzcd}$$

(II)

$$\begin{tikzcd} \boxed{T_1} & \boxed{T_2} \arrow[l] & \boxed{T_3} \arrow[l] \end{tikzcd}$$

(III)

$$\begin{tikzcd} \boxed{T_1} \arrow[r] & \boxed{T_2} \arrow[r] & \boxed{T_3} \arrow[ll, bend left] \end{tikzcd}$$

(IV)

$$\begin{tikzcd} \boxed{T_1} \arrow[r] \arrow[rr, bend left] & \boxed{T_2} \arrow[r] & \boxed{T_3} \end{tikzcd}$$

(V) None of the above

☐ **A.** (I)

☐ **B.** (II)

☐ **C.** (III)

■ **D.** (IV)

☐ **E.** (V)

5. Which of the precedence graphs shown in **Question 4** is not conflict-serialisable?

☐ **A.** (I)

☐ **B.** (II)

■ **C.** (III)

☐ **D.** (IV)

☐ **E.** (III) and (IV)

6. Consider the following schedule:

$S_1 : r_3(X); r_2(Y); w_1(X); w_2(Y); r_2(Y); r_3(Y); w_1(Y); w_3(Z)$

This schedule is conflict-equivalent to which one of the following serial schedules?

■ **A.** $S_1 : r_2(Y); w_2(Y); r_2(Y); r_3(X); r_3(Y); w_3(Z); w_1(X); w_1(Y)$

☐ **B.** $S_1 : w_1(X); w_1(Y); r_2(Y); w_2(Y); r_2(Y); r_3(X); r_3(Y); w_3(Z)$

☐ **C.** $S_1 : r_3(X); r_3(Y); w_3(Z); r_2(Y); w_2(Y); r_2(Y); w_1(X); w_1(Y)$

☐ **D.** $S_1 : r_3(X); r_3(Y); w_3(Z); w_1(X); w_1(Y); r_2(Y); w_2(Y); r_2(Y)$

☐ **E.** $S_1 : r_2(Y); w_2(Y); r_2(Y); w_1(X); w_1(Y); r_3(X); r_3(Y); w_3(Z)$

7. Consider the following precedence graph:

$$\begin{tikzcd} \boxed{T_1} \arrow[r] \arrow[d] & \boxed{T_2} \arrow[d] \\ \boxed{T_3} \arrow[r] & \boxed{T_4} \end{tikzcd}$$

Which of the following pair of conflict-equivalent serial schedules is this graph equivalent to?

☐ **A.** T_2-T_1-T_3-T_4 and T_3-T_1-T_4-T_2

■ **B.** T_1-T_2-T_3-T_4 and T_1-T_3-T_2-T_4

☐ **C.** T_2-T_1-T_4-T_3 and T_3-T_1-T_2-T_4

☐ **D.** T_1-T_3-T_4-T_2 and T_1-T_2-T_4-T_2

☐ **E.** T_3-T_1-T_4-T_2 and T_4-T_1-T_2-T_3

8. Consider the following schedule?

Time	**Transaction T_1**	**Transaction T_2**
1	read_item(X)	
2	read_item(Y)	
3	Y := X - 50	
4		read_item(X)
4		read_item(Y)
5		X := Y + 50
6		write_item(X)
7		commit
8	write_item(Y)	
9	commit	

What happens when we execute this schedule with initial values $X = 50$ and $Y = 50$? (Assume that read_item and write_item read values from and write values to a shared buffer, respectively.)

☐ **A.** The schedule does not finish, because deadlock occurs

■ **B.** The schedule finishes execution with $X = 100$ and $Y = 0$ on disk

☐ **C.** The schedule finishes execution with $X = 50$ and $Y = 50$ on disk

☐ **D.** The schedule finishes execution with $X = 50$ and $Y = 0$ on disk

☐ **E.** None of the above

9. Have a look at the following schedule with locks. Which statement is correct for this schedule:

S_1 : $sl_2(Y)$; $r_2(Y)$; $sl_1(X)$; $r_1(X)$; $ul_1(Y)$; $r_1(Y)$; $xl_1(Y)$; $w_1(Y)$; $u_1(Y)$; $u_1(X)$; $sl_2(X)$; $r_2(X)$; $u_2(X)$; $u_2(Y)$

■ **A.** T_1's request for an exclusive lock on Y is denied

☐ **B.** T_1's request for an update lock on Y is denied

☐ **C.** T_1's request for a shared lock on X is denied

☐ **D.** T_2's request for a shared lock on Y is denied

☐ **E.** None of the above

10. Consider the following schedules using locks. Which of these schedules are allowed by 2PL?

(I) S_1: $l_1(X); r_1(X); w_1(X); l_1(Y); u_1(X); \cancel{l_2(X);}\ r_2(X); \cancel{r_1(X);}\ w_1(Y); u_1(Y); l_2(Y); r_2(Y); w_2(X); w_2(Y); u_2(X); u_2(Y)$

(II) S_2: $l_1(X); l_1(Y); r_1(X); w_1(X); u_1(X); l_2(X); r_2(X); r_1(Y); w_1(Y); u_1(Y); l_2(Y); r_2(Y); w_2(X); u_2(X); w_2(Y); u_2(Y)$

(III) S_3: $l_1(X); r_1(X); w_1(X); u_1(X); l_2(X); r_2(X); l_1(Y); r_1(Y); w_1(Y); u_1(Y); l_2(Y); r_2(Y); w_2(X); w_2(Y); u_2(X); u_2(Y)$

(IV) S_4: $l_1(X); r_1(X); w_1(X); u_1(X); l_1(Y); r_1(Y); w_1(Y); u_1(Y); l_2(X); r_2(X); w_2(X); u_2(X); l_2(Y); r_2(Y); w_2(Y); u_2(Y)$

(V) S_5: $l_1(X); r_1(X); w_1(X); l_1(Y); u_1(X); r_1(Y); w_1(Y); u_1(Y); l_2(X); r_2(X); w_2(X); l_2(Y); u_2(X); r_2(Y); w_2(Y); u_2(Y)$

☐ **A.** (I) and (IV)

☐ **B.** (I), (II) and (III)

■ **C.** (II) and (V)

☐ **D.** (I), (IV) and (V)

☐ **E.** (IV) and (V)

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<u>PLEASE NOTE.</u> Exam set is NOT using subscript to make it easier to read.

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1. Consider the following database schema and example instance for a property management system:

property

pId	price	owner	sqrFeet	location
1	100,000	Alice	560	Lake View
2	3,400,000	Bob	2,000	Hyde Park
3	1,200,000	Bob	1,200	Hyde Park
4	5,000,000	Martha	800	Evanston

repairs

rId	pId	company	date	type
1001	1	M.M. Plumbing Ltd.	2013-12-12	Bathroom
1002	2	M.M. Plumbing Ltd.	2013-12-13	Kitchen
1003	4	Rob's Double Glazing	2012-01-01	Windows

Hints:

- Attributes with a grey background form the primary key of a relation (e.g, *pId* for relation *property*).
- The attribute *pId* of relation *repairs* is a foreign key to relation *property*.

Which answer gives the correct relational algebra expressions to return the results for the following **two** queries:

i. Get the pId, owner and location details of all properties that are larger than 900 square feet (sqrFeet).

ii. Get the names of repair companies (company) that did a repair on a property in Hyde Park.

■ **A.** πpId, owner, location (σsqrFeet > 900 (property))

πcompany (σlocation = 'Hyde Park' (property) ⋈ repairs)

□ **B.** πpId, owner, location (σsqrFeet < 900 (property))

πcompany (σlocation = 'Hyde Park' (property))

□ **C.** σpId, owner, location (σsqrFeet > 900 (property))

σcompany (πlocation = 'Hyde Park'(property) ⋈ repairs)

□ **D.** πpId, owner, location (σsqrFeet > 900 (property))

πcompany (σloc = 'Hyde Park' (property) ⋈ repairs)

□ **E.** πpId, owner, location (σsqrFeet > 900 (repairs))

πcompany (σlocation = 'Hyde Park' (property) ⋈ repairs)

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2. Consider the following schema, where the primary key is underlined.

Person(<u>personId</u>, first_name, last_name, address)

Consider the following queries.

- **SQL Query:** SELECT first_name, last_name FROM Person;
- **Relational Algebra Query:** $\pi_{first\_name,\ last\_name}$ (Person)

Can the two queries have different number of tuples in their outputs?

□ **A.** Yes, it's possible that the Relational Algebra Query can have more tuples than the SQL Query.

■ **B.** Yes, it's possible that the SQL Query can have more tuples than the Relational Algebra Query.

□ **C.** No, both queries will return the same number of tuples.

□ **D.** Not enough information.

□ **E.** None of the above.

3. Assume a basic checkpointing recovery protocol. Suppose the following schedule is being run:

(start, T1);
(w1, A, 1200, 1000);
(commit, T1);
(checkpoint);
(start, T2);
(w2, B, 1500, 1800);
(start, T3);
(w3, A, 1000, 500);
(start, T4);
(w4, C, 3000, 4000);
(w3, D, 3000, 2000);
(commit, T3);
(w2, A, 500, 1500);

Suppose the schedule crashes at this point. What are the undo and redo lists in the correct order?

□ **A.** Undo List: T4, T2; Redo List: T1

□ **B.** Undo List: T2, T4; Redo List: T3

□ **C.** Undo List: T4, T2; Redo List: T1, T3

■ **D.** Undo List: T4, T2; Redo List: T3

□ **E.** Undo List: T2, T4; Redo List: T1

4. In a Wait-Die scheme, transactions T1 and T2 have timestamps 10 and 15, respectively.

In a Wound-Wait scheme, transactions T1 and T2 have timestamps 2 and 5, respectively.

Select the correct option if the following happened in the Wait-Die and Wound-Wait schemes, respectively.

i. Wait-Die: If T2 requests a data item held by T1.

ii. Wound-Wait: If T1 requests a data item held by T2.

■ **A.** Wait-Die: T2 will be rolled back. Wound-Wait: T2 will be rolled back.

□ **B.** Wait-Die: T2 will wait. Wound-Wait: T1 will wait.

□ **C.** Wait-Die: T1 will be rolled back. Wound-Wait: T2 will be rolled back.

□ **D.** Wait-Die: T1 will wait. Wound-Wait: T2 will wait.

□ **E.** Wait-Die: T1 will be rolled back. Wound-Wait: T1 will be rolled back.

5. Given the schedule S, which of the following is true?

S : r1(X); r3(Y); r3(X); w1(X); c1; w2(Y); r2(X); w3(Y); c2; c3

□ **A.** S is not recoverable.

□ **B.** S is recoverable but not cascadeless.

■ **C.** S is cascadeless but not strict.

□ **D.** S is strict.

□ **E.** None of the above.

6. Suppose we have a relation R(a, b, c, d, e) and there are at least 1000 distinct values for each of the attributes. Consider each of the following query workloads, independently of each other.

i. 100,000 queries have the form: SELECT * FROM R WHERE b < x;

ii. 10,000 queries have the form: SELECT * FROM R WHERE c = y;

Which of the following would speed up both queries significantly?

■ **A.** First query: Clustered B+-tree index on R(b). Second query: Unclustered B+-tree or hash-based index on R(c).

□ **B.** First query: Clustered B+-tree index on R(b). Second query: Clustered B+-tree or hash-based index on R(c).

□ **C.** First query: Clustered hash-based index on R(b). Second query: Unclustered B+-tree or hash-based index on R(c).

□ **D.** First query: Clustered hash-based index on R(b). Second query: Clustered B+-tree or hash-based index on R(c).

□ **E.** First query: Clustered B+-tree index on R(c). Second query: Unclustered B+-tree or hash-based index on R(b).

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7. Suppose we are using timestamp-based concurrency control, and there are two transactions T1 and T2 with timestamps 1 and 2, respectively. They try to execute the following sequence of actions in the order shown:

r1(A); r2(B); w1(B); w2(A);

Which of the following best characterizes what happens?

□ **A.** All four actions succeed.

□ **B.** w1(B) succeeds, but w2(A) fails and causes T2 to abort.

■ **C.** w1(B) fails and T1 aborts; then w2(A) succeeds.

□ **D.** w1(B) and w2(A) both fail and cause their transactions to abort.

□ **E.** w1(B) fails and causes both T1 and T2 to abort.

8. Consider the following relation:

studentCourses(StudentID, CourseNo, Quarter, Year, Units, Grade)

The relation contains the grades for the courses completed by students. Assume that in studentCourses there are 200,000 different students, each identified by their StudentID. On average, a student took 40 different courses.

If the file blocks hold 2000 bytes and each studentCourses tuple requires 50 bytes, how many blocks will then be needed to store the relation studentCourses?

■ **A.** (200000 * 40 * 50) / 2000 = 200000

□ **B.** (200000 * 50) / 2000 = 5000

□ **C.** (200000 * 40) / 2000 = 4000

□ **D.** ((200000 * 40) / 2000) / 50 = 80

□ **E.** None of the above.

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9. A database includes two relations Student (S) and Program (P).

S

Student_No	**F_Name**	**L_Name**	**Prog_Code**
04009991	Alicia	Smith	0001
04009992	Alan	Smith	0002
04009995	Alicia	Bush	0001
04009995	John	Smith	0001

P

Prog_Code	**P_Name**
0001	Computing
0002	Software Engineering

Select the relational expression that could possibly return the following result:

F_Name	L_Name	P_Name
Alicia	Smith	Computing
John	Smith	Computing

☐ **A.** πF_Name, L_Name, P_Name (πL_Name = ’Smith’ AND P_Name = ’Computing’ S) ⋈ P)

☐ **B.** πF_Name, L_Name, P_Name (σL_Name = ’Smith’ (S ⋈ P))

☐ **C.** σF_Name, L_Name, P_Name (πL_Name = ’Smith’ AND P_Name = ’Computing’ (S ⋈ P))

■ **D.** πF_Name, L_Name, P_Name (σL_Name = ’Smith’ AND P_Name = ’Computing’ (S ⋈ P))

☐ **E.** None of the above.

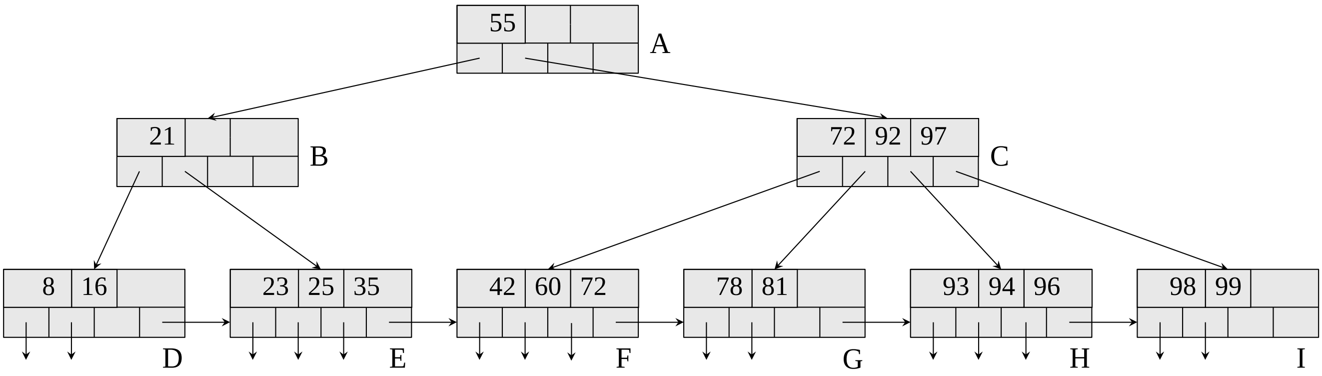


Figure 1: B+ tree for Question 10.

10. Consider the B+ tree in Figure 1 on the current page. What happens if we insert 90 into this B+ tree?

□ **A.** A new node, K, is inserted between G and H. The value 93 and its pointer are moved from H to K, and 90 is inserted into K. Finally, K is added as a child to C, which results in splitting C into two nodes, where the new node is added as a child to A.

■ **B.** We insert 90 into G.

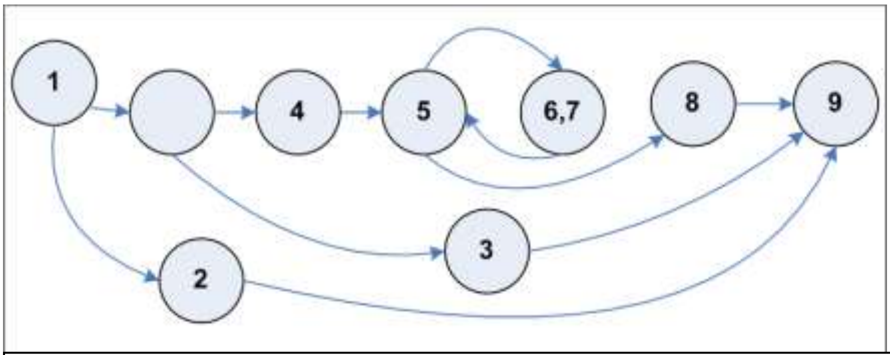
□ **C.** We attach two children to H and distribute all the values in H evenly across the new children.

□ **D.** A new node, K, is inserted between G and H and added as a child to C, which results in splitting C into two nodes. We do not change H, but insert 90 into K.

□ **E.** We split C into two nodes, where the second node is added as a child to A. The values 92 and 97 are moved to the new node, and 90 is inserted into C.

Practise questions

Look at the following flow chart and corresponding source code. Use these to answers questions 1 to 3.




```
int factorial(int x) {
        if (x<0) {                                      // 1
                throw new BadArgumentException();       // 2
        }
        if (x==0) {
                return(1);                              // 3
        }
        int result=1;                                   // 4
        while (x!=1) {                                  // 5
                result=result*x;                        // 6
                result--;                               // 7
        }
        return(result);                                 // 8
}                                                       // 9
```

Q1. What is the minimum number of tests required to test every piece of this code?

a) 3
b) 4 **Answer is (b)**
c) 5
d) 6
e) 7

Q2. Given the following test suite

(X=-20)

(X==1)

Which nodes are not covered by this suite?

a) (2),(3)
b) (3),(6,7) Answer is B
c) (2),(6,7)
d) (2)
e) (2),(3),(6,7)

Q3 Which of the following is untrue about blackbox testing?

a) It often uses testing partitions to determine appropriate test coverage.
b) Each path in program is guaranteed to be executed at least once
c) The source code is not known by the tester **Answer is B because source is hidden**
d) Test data values are often set to the edge of partition boundaries
e) The tests are according to the system specification

Q4 Look at the following fragment specification "The method will accept a date in the form of 3 variables, a day of month, a month of year and a year. The month is set to 1 for January, 2 for February etc.". Given that the month=2 and year=2014, which of the following day settings would test all boundaries for the method.

a) 1, 28
b) 1,28,29
c) 0,1,28,29 **// Answer is C (Note 2014 is not leap year)**
d) 0,1,28,29,30
e) 0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28

Q5. Look at the description of a fire alarm given in Appendix A, which of the following describes the possible Actors of the system?

a) Bank staff, security guards, engineer
b) Smoke sensors, security sensors, heat sensors
c) Bank staff, security guards, security sensors, heat sensors, smoke detectors
d) Bank staff, security guards, security sensors, heat sensors, smoke detectors, police, fire brigade **Answer is D… all these are Actors**
e) Police, fire brigade

Q6 What would be the role of the use case "Fire confirmed"

a) Included as part of “Detect heat”, “Detect Smoke” use cases
b) Extended from “Detect heat”, “Detect Smoke” use cases **Answer is B**
c) Extended from “Detect heat”, “Detect Smoke”, “Fire button pressed” use cases
d) Included as part of“Detect heat”, “Detect Smoke”, “Fire button pressed” use cases
e) None of the above

“An organisation is using the Bell–LaPadula security model to control their communications and controlling all their communications. They have a bulletin board which all staff can post messages on to. Given that Alice has top clearance (level 4), Bob has middle clearance (level 2), Karen (level 1) and Derek has low level clearance (level 0). Bob posts a message inviting all staff to a BBQ. Answer questions 7 and 8, assuming all staff who receive a message, reply to it on the bulletin board by the end of the working day.

Q7 What messages would Karen (level 1) staff be able to read from the board at the end of the day (when everyone would have replied).

a) No messages The answer is A because… she would not be able to read Bob’s message at level 2… or any replies from readers of Bob’s message as these would also have level 2 or above clearance
b) Messages from Alice and Bob only
c) Messages from Alice, Bob and Derek only
d) Messages from Alice, Bob, Derek and Karen only
e) Messages from

Q8 What messages would Bob be able to read at the end of the day?

a) No messages
b) Only his own only Answer is B he could not read Alice’s reply as she is level 4 and he is only level 2
c) Alice and his own messages only
d) His own message’s and Karen and Derek
e) No messages

Q9 Assuming everyone wants to go to the BBQ, who will be there?

a) Everyone only
b) No one only
c) Alice and Bob only // Answer is C .. Alice’s get’s Bob’s message, Bob knows about the BBQ anyway
d) Alice, Bob and Derek only
e) Bob only

Q10 What is authentication?

a) Checking messages have not been altered
b) Keeping messages secret
c) Keeping messages with a timestamp

d) Verifying the identity of a user of the system   Answer is D
e) Controlling access rights to data

Q11 Why is partition testing useful?

a) It helps to ensure that all paths are tested.
b) It covers every single value that a test data item can be
c) It helps to uncover incorrect use of comparator operators such as less than and less than or equals. **// Answer is C**
d) It helps to stress the system
e) Non of the above

Q12 Which of the following is not true about petri-nets?

i) They are deterministic
ii) They can be used to model systems with finite state
iii) Places can fill up, so no more tokens can enter
iv) A transition is always enabled if all its incoming places contain a token

a) i) and iii) and iv)   (iv is not right because place might have weighting)

b) ii) and iv)
c) ii) only
d) all of the above
e) none of the above

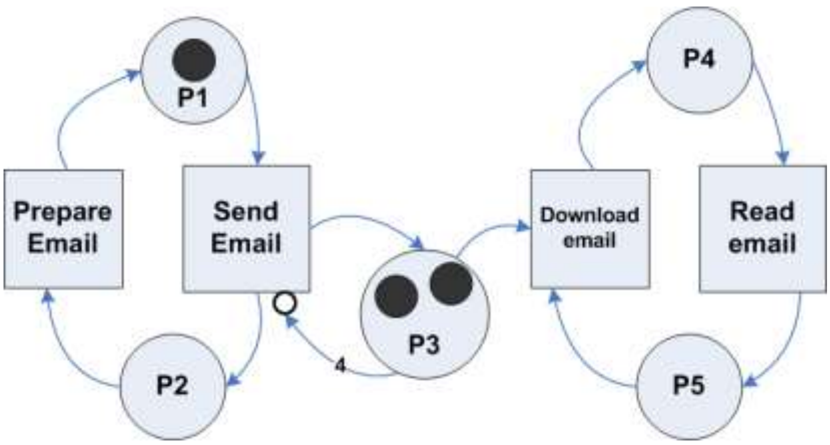


Figure 1 Petri Net

Q13 Looking at the model of the petri-net shown in Figure 1, showing an email sending system. What transitions will be enabled if the Send Email transition fires?

a) Prepare Email, download email only
b) Prepare Email only   // Answer is B

c) Prepare Email and send email only
d) Deadlock (no states) only
e) Send email and read email only

Q14 Starting at the state given in Figure 1, what transitions will be enabled after the following sequence, send Email, prepare Email?

a) Prepare Email, download email only
b) Prepare Email only
c) Prepare Email and send email only
d) Deadlock (no states) only
e) Send email only **// Answer is e)**

Q15 Starting at the state given in Figure 1, what transitions will be enabled after the following sequence, send Email, prepare Email, send Email, prepare Email?

a) Prepare Email, download email only
b) Prepare Email only
c) Prepare Email and send email only
d) Deadlock (no states) only // Answer is d … 4 tokens in P3 will disable send-email
e) Send email only

Q16 What do the tokens in P3 represent?

a) Messages written but not sent
b) Messages sent but not downloaded // Answer is B
c) Messages downloaded but not read
d) Maximum messages that can be sent
e) Sender of email

Q17 What is the maximum number of messages can be transit?

a) 1
b) 2
c) 3
d) 4 // Only 4 messages can be in transit
e) 5

Q18 What is the maximum number of states that the net can achieve?

a) 1
b) 2
c) 4 // Only 4 states before deadlock
d) 6
e) Infinite (no max)

Q19 What is wrong with the configuration of the net?

a) Nothing
b) There should be no connection between P3 and send Email
c) There is a token missing from the right hand side Answer is C.. without this token emails cannot be read
d) There should be no token in P1
e) P1 should contain 2 tokens

Q20 What do tokens in P2 represent?

a) Editors of email // Answer is A…
b) Readers of email
c) Email messages yet to be sent
d) Email messages yet to be read
e) None of the above

21 Which of the following are **NOT** verifiable requirements?

X1: Product high cohesion
X2: Server response delay has an average of 200ms
X3: Software is easy to use
X4: Software is written in Java

☐ **(A)** X1 and X2
☐ **(B)** X1, X2 and X3
☐ **(C)** All of the above
☐ **(D)** X2 and X4
☐ **(E)** X1 and X3 // Answer is E

22 Which of the following techniques are suitable for cost estimation of a new project where comparable software has not been produced, and there are no available experts in the project application domain?

X1 Algorithmic cost modelling
X2: Parkinson's Law
X3: Pricing to win
X4 Expert judgement

X5 Estimation by analogy

- ☐ **(A)** X1 and X2
- ☐ **(B)** X2 and X5
- ☐ **(C)** X3 and X4
- ☐ **(D)** X2 and X4
- ☐ **(E)** X2 and X3 // Answer is E)

23 What does the following describe : “The project costs expand to consume whatever resources are available”?

- ☐ **(A)** Expert judgement
- ☐ **(B)** Parkinson’s law Answer is B
- ☐ **(C)** Estimation by analogy
- ☐ **(D)** Simulation
- ☐ **(E)** Validation estimation

24 Which of the following is a process in the waterfall software lifecycle?

- ☐ **(A)** Risk analysis
- ☐ **(B)** Prototyping
- ☐ **(C)** Iteration

- ☐ **(D)** Integration and system testing // Answer is D
- ☐ **(E)** Spiralling

Appendix A

Proposed combined security and fire system

An international bank has contracted your company to develop a software system to monitor and control a fire and security system in its new building. The building is divided into seven distinct zones and each zone contains several smoke detectors (which detect the presence of smoke), several heat detectors, fire alarm buttons (which a person can push if they detect a fire) and security sensors (which detect the presence of people in the zone and can trigger an alarm when outside normal banking hours or during holidays for example). Through interviews with bank personnel and an initial proposal, it has been determined that the following factors of the new system should be taken into account: A password may be entered by bank staff when entering/leaving a zone outside normal hours which will activate/deactivate the security system for the zone (i.e., once a zone is deactivated, the police won't be called if the security sensors detect movement so that staff can work out-of-hours). Each member of staff is allocated a number of zones that they are permitted to work in after hours. When a smoke detector detects smoke, or excess heat it will send a message to the software system to report it. All building alarms should then be sounded. The fire brigade should be automatically contacted *once a fire is confirmed* (since it may be a false alarm). The bank specified that a fire should be called "confirmed" if either two sensors detect smoke or heat, or else *any* fire alarm button has been pushed. To reset the alarm a bank security guard can reset the system and all alarms in the event of a false alarm after checking the particular zone. To do this function a dual key mechanism is used, that is two security guards are required to reset the alarm. For some zones there are sprinkler systems which can be activated automatically or by a security guard *if a fire is confirmed and no one is in that zone*. The security subsystem can automatically call the police and lock all internal doors to isolate zones and avoid intruders being able to move freely within the building if movement is detected out-of-hours (you should consider the possibility of BOTH an intruder being detected and a fire confirmed at the same time; ALL internal doors should obviously be unlocked in this case.) The security guard can periodically test the system so that any malfunctions can be rectified.