General Ability

Answer Keys

1	D	**2**	C	**3**	60	**4**	D	**5**	D	**6**	D	**7**	B
8	B	**9**	299.7	**10**	B								

Computer Science

1	B	**2**	B	**3**	B	**4**	D	**5**	3	**6**	A	**7**	C
8	A	**9**	B	**10**	8	**11**	B	**12**	C	**13**	3	**14**	A
15	A	**16**	C	**17**	D	**18**	5	**19**	D	**20**	D	**21**	A
22	B	**23**	C	**24**	D	**25**	C	**26**	C	**27**	184.32	**28**	82
29	B	**30**	7	**31**	C	**32**	C	**33**	D	**34**	D	**35**	A
36	7351	**37**	0.66	**38**	A	**39**	A	**40**	2.78	**41**	D	**42**	A
43	B	**44**	A	**45**	D	**46**	B	**47**	19.99	**48**	D	**49**	A
50	8	**51**	1	**52**	A	**53**	D	**54**	D	**55**	56		

Explanations:-

1. Barrack, duplex and gazebo are spaces used for specific purposes while imbrue (which means soaked) does not fit in the group.

2. The man was treated as madman, hence the word in the first blank will be 'deranged'; the others (many) considered themselves to be sober and wise hence 'prudence' fits in the second blank

3. Let breadth = x metres.
Then, length = $(x + 20)$ metres.

$$\text{Perimeter} = \frac{5300}{26.5}\text{m}$$
$$= 200\text{m}$$
$$\Rightarrow 2\left[(x + 20) + x\right] = 200$$
$$\Rightarrow 2x + 20 = 100$$
$$\Rightarrow 2x = 80$$
$$\Rightarrow x = 40.$$

Hence, length = $x + 20 = 60$ m.

4. Cataclysmic and catastrophic means disastrous.

5. Option 1 uses past continuous tense which is not required since a truth is mentioned which should be in present tense. Option 2 is wrong because there is unnecessary use of present continuous tense. Option 3 is wrong because 'so' changes the meaning of the sentence and 'downward on the surface' should be replaced with 'downward from the surface'.

6. Time taken by A to fill the tank = 72 min
Time taken by B to fill the tank = 90 min
Time taken by C to empty the tank = 60 min
Pipes A and B are opened for 14 min.
Part of the tank filled is

$= 14 \text{ x } (\frac{1}{72}+\frac{1}{90}) = \frac{7}{20}$

Remaining part of the tank = $(1-\frac{7}{20}) = \frac{13}{20}$

Now all the pipes are opened

$t \text{ x } (\frac{1}{72}+\frac{1}{90}-\frac{1}{60}) = \frac{13}{20}$

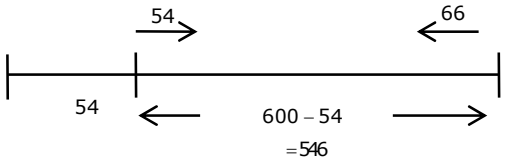
t = time taken to fill remaining part of the tank
t = 78 min
Total time = 78 + 14 min
= 92 min = 1 hr 32min

7. $4+x+6+8+y+0$ must be divisible by 3
$18+x+y$ must be divisible by 3
and, $(x+8+0)-(4+6+y)$
$= x-y-2$ must be either 0 or 11
$x-y-2=0 \Rightarrow y = x-2$
$18+x+x-2 = 16+2x$
$\Rightarrow$ x can be only 7
$\therefore y = 5$

8. $6 = \text{LCM of } (2\&3)$; $12 = \text{LCM of } (3,4)$
$20 = \text{LCM of } (4,5)$; $30 = \text{LCM of } (5,6)$
So the missing numbers P = LCM of (12, 60) = 60
and Q = LCM of (60, 60) = 60

9. Distance between A and B is 600km

Speed of first train = 54km/hr
Speed of second train = 66km/hr
But 2nd train started 1 hr after the first. So first train might have covered 54 km



Relative speed = 54 + 66 = 120km/hr

$\therefore$ Time taken $= \frac{546}{120} = 4.55$

First train travels 54 × 4.55 km i.e. 299.7km by the time they meet

10. Option 1 is wrong because 'intellect' is not given in the paragraph. Option 3 can be eliminated because it represents 'long process of growth of aesthetic ideas' as a hurdle by using the word 'though'. Option 4 is wrong since it was not instinct that was discovered.

1. Under local page replacement policy, the set of pages in the memory for a process is affected by the paging behavior of only that process. Because of this, local replacement might hinder a process by not making available to it other less used pages of memory. Thus, global replacement generally results in greater system throughput.

3. In any simple graph there exists at least 2 vertices with the same degree (using pigeonhole principle) and it is true irrespective of whether the graph is connected or disconnected.
If there are 2 odd degree vertices in the graph they must be present in the same connected component as there can not be odd number of odd degree vertices in any component. So, they must be connected by a path.

4. $P \rightarrow (Q \rightarrow R) \Leftrightarrow \sim P \vee (\sim Q \vee R) \Leftrightarrow \sim P \vee \sim Q \vee R \Leftrightarrow \sim(P \wedge Q) \vee R \Leftrightarrow (P \wedge Q) \rightarrow R$

5. (c, e), (b, c), (d, e)

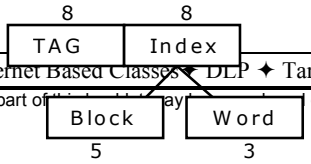
6. S1: This is for TCP flow control

S2: TCP sequence number count bytes in the byte stream rather than packets. If u bytes are sent then subsequent sequence number will be (m+u).

8. 141.14.196.46 141.14. 11000100:00101110
Subnet mask 255.255.11000000.00000000
Subnet id will be 141.14. 192.0

9. With increasing set associativity, number of sets will decrease and so tag size will increase.

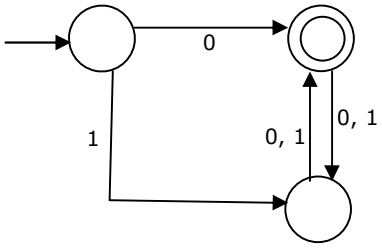
10. Memory address: 16 bits



Number of words in cache = $256 = 2^8$

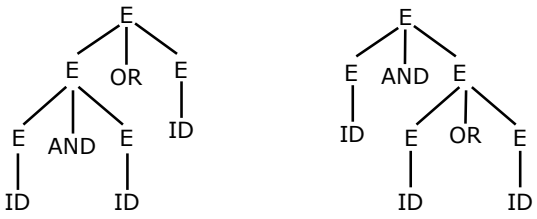
12. Union of two CFL is CFL.
Concatenation of two CFL is CFL and complement of CFL is CSL.

13.



14. The right most derivation of the string xxxxyzz is:
$S \rightarrow xxW \rightarrow xxSz \rightarrow xxxxWz \rightarrow xxxxSzz \rightarrow xxxxyzz$
A shift reduce parser performs the right most derivation in reverse. So first it reduces the y to S, by the production S → y. As a consequence of this, b is immediately printed. Next, Sz is reduced to W and so on. So the answer is bcaca.

15. The given grammar is ambiguous. No ambiguous grammar is LL(1).



16. If queue is empty algorithm terminates and if it not empty, delete operation will be performed at the front end and it will be collected in the variable 'i' and will be inserted at the end of the queue.

18. Since f(x) and g(x) satisfied the conditions of cauchy';s mean value theorem in [1,2]

$$\therefore \frac{f'(x)}{g'(x)} = \frac{f(2)-f(1)}{g(2)-g(1)}$$

$$\Rightarrow 2 = \frac{8-2}{g(2)-2} \quad (\because f'(x) = 2g'(x))$$

$$\Rightarrow g(2) = 5$$

19. The grammar is left recursive (in both rules $S \to SaSb$ and $Q \to Qm$) LL passers cannot handle left recursion.

20. Suppose $R(ABC)$ and $S(BC)$ are given relations. $R \div S$ contains the tuples in which each A combination in R is associated with all combinations of BC in S and in all those tuples only attribute A is projected.

R

A	B	C
a	1	2
b	1	2
a	1	4
c	1	4

S

B	C
1	2
1	4

$R \div S$

A
a

$$\therefore \text{degree}(R \div S) = \text{degree}(R) - \text{degree}(S)$$

21. (1) is not possible as T3 cannot come before T2 according to the precedence graph given
(3) & (4) are not possible as T2 cannot come before T4 according to the precedence graph given below.

22. Here T2 is reading data item written by T1 so for the given schedule to be cascadeless, the read operation of T1($r_2(x)$) should appear only after commit operation of T1(C1).

23. Let $AB + \overline{A}C = 1 \ \ldots(1)$ and $AC + B = 0 \ \ldots(2)$

Consider equation (2)

$AC + B = 0$

$AC = 0$ and $B = 0$

Substitute $B = 0$ in (1)

$A.0 + \overline{A}C = 1$

$\overline{A}C = 1$

$\overline{A} = 1$ and $C = 1$

$A = 0, B = 0, C = 1$

25. $f(A,B,C) = AB + BC + CA$

$fd(A,B,C) = (A+B)(B+C)(C+A) = (AC + B(A+1+C))(C+A)$

$= (AC+B)(C+A) = AC + BC + AB \Rightarrow$ self dual

26.

$(\$ \text{ stack, input } \$)$

$(\$ \text{ , } aaa + a * + \$)$

$(\$ \text{ a, } aa + a * + \$)$

$(\$ \text{ A, } a\ a + a * + \$)$

$(\$Aa, a + a * + \$)$

$(\$AA, a + a * + \$)$

$(\$AAa, + a * + \$)$

$(\$AAA, + a * + \$)$

$(\$AAA+, a * + \$)$

$(\$A\ A, a * + \$)$

$(\$\ A\ A\ a, * + \$)$

$(\$AAA, * + \$)$

$(\$AAA*, + \$)$

$(\$\ A\ A, + \$)$

$(\$\ AA +, \$)$

$(\$A, \$)$

27. Speed = 100Mbps; $\text{efficiency} = \dfrac{1}{1+5\dfrac{T_{prop}}{T_{trans}}}, \dfrac{1}{2} = \dfrac{1}{1+5\dfrac{T_{prop}}{T_{trans}}}, 1+5\dfrac{T_{prop}}{T_{trans}} = 2$

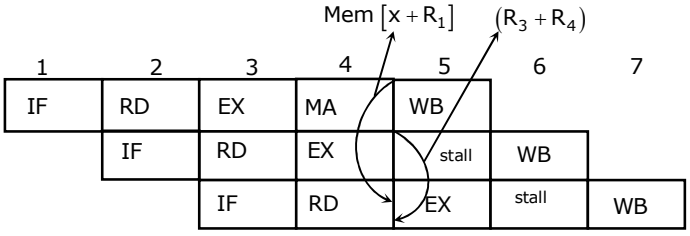
$5T_{prop} = T_{trans}, T_{prop} = \dfrac{T_{trans}}{5}, T_{trans} = \dfrac{64\times 8}{100\times 10^6} = 5.12\mu S, T_{prop} = \dfrac{5.12\mu S}{5} = 1.024\mu S$

$T_{prop\ delay} = \dfrac{\text{distance}}{\text{speed}}, \dfrac{\text{distance}}{\text{speed}} = 1.024\ \mu s, \text{distance} = \left(\dfrac{1.024\times 1.8\times 10^8}{10^6}\right) m = 184.32m$

28. Given frame size L = 512 bytes, data rate B = 10 Mbps
Contension period = Number of contension slots × slot duration = 1.716 × 51.2μsec.
Transmission period(TP) $= \dfrac{L}{B} = \dfrac{512\times 8}{10\times 10^6} = 410\mu\text{sec}.$
Channel utilization $\eta = \dfrac{TP}{TP+CP} = \dfrac{410}{410+1.716\times 51.2} = 82\%$

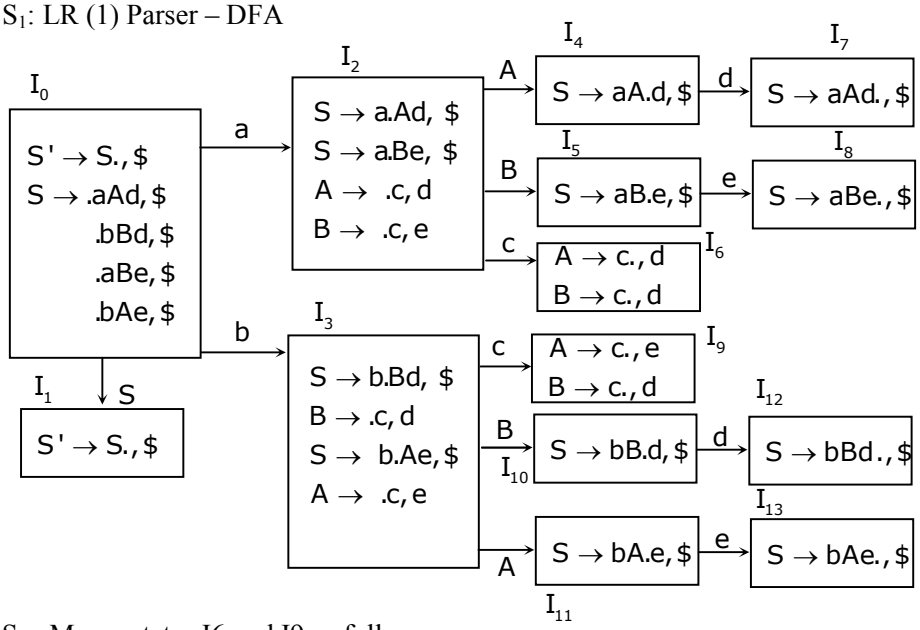
29. Iteration 1 : search through all n nodes
Iteration 2 : search through all (n-1) nodes
Iteration 3 : search through all (n-2) nodes
And so on $\therefore$ Total $= \dfrac{n(n+1)}{2}$

30.

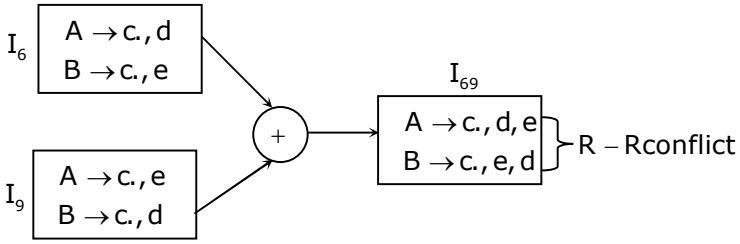


31. (i) Not possible to construct DFA, because it needs memory to recognize reverse string
(ii) Equivalent regular expression is $a(a+b)^+a + b(a+b)^+b$
(iii) It is finite language and every finite language is regular
(iv) It is CSL but not regular

32. S_1: LR (1) Parser – DFA



S_2 : Merge states I6 and I9 as follows:



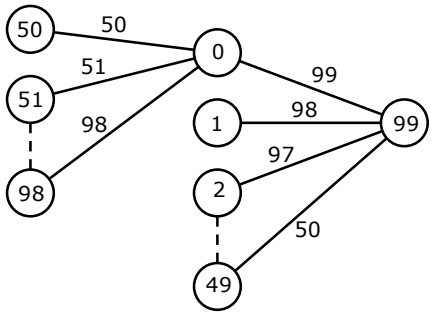
33. Topological sort is the linear ordering of nodes of directed graph so that the directed edges go from only left to right.
In both I, iii all the directed edges go from left to right only.
In ii, the edge from D to E cannot go from left to right.

35. Let $m = \log n$, then $n = 2^m, t(2^m) = 2t\left(2^{\frac{m}{2}}\right) + m$

Let $t(2^m) = S(m), S(m) = 2S\left(\frac{m}{2}\right) + m \therefore S(m) = \Theta(m \log m)$

Then $t(n) = t(2^m) = S(m) = \Theta(m \log m) = \Theta(\log n \log\log n)$

36. $|u - v|$ is maximum if u and v are as far apart from each other as possible. So, keeping this thing in mind, maximum weighted spanning tree will look like



$\therefore$ Required weight $= 2*(50+51+.....+98)+99$

$= 2\times\frac{49}{2}(50+98)+99 = 49*148+99 = 7351$

37. Given equation can be written as

$$x\cos x\frac{dy}{dx}+y\cos x-xy\sin x-\sin x=0$$

$$x\cos x\frac{dy}{dx}+y(\cos x-x\sin x)=\sin x\Rightarrow\frac{dy}{dx}+y\left(\frac{\cos x-x\sin x}{x\cos x}\right)=\frac{\sin x}{x\cos x}$$

$$I.F = x\cos x$$

$$\frac{dy}{dx}-\cot x.y=-\operatorname{cosec}x.y^2\Rightarrow\frac{1}{y^2}\frac{dy}{dx}-\cot x.\frac{1}{y}=-\operatorname{cosec}x$$

$$\text{Let }\frac{-1}{y}=z\Rightarrow\frac{1}{y^2}\frac{dy}{dx}=\frac{dz}{dx}$$

$$\frac{dz}{dx}+\cot x.z=-\operatorname{cosec}x$$

$$I.F = e^{\int\frac{\cos y}{\sin x}dx}=\sin x$$

$$z\sin x=\int(-\operatorname{cosec}x)\sin x dx+c\Rightarrow z\sin x=-x+c$$

$$\text{at } x=\frac{\pi}{4}, y=\sqrt{2}$$

$$\Rightarrow\frac{-1}{\sqrt{2}}\times\frac{1}{\sqrt{2}}=\frac{\pi}{4}+c\Rightarrow c=\frac{\pi}{4}-\frac{1}{2}$$

$$\text{now }\frac{\sin x}{y}=x+c$$

$$\Rightarrow\text{at } x=-\frac{\pi}{4}\Rightarrow y=\frac{\sin x}{x+c}$$

$$y=\frac{\sin\left(-\frac{\pi}{4}\right)}{\frac{\pi}{4}+\frac{\pi}{4}-\frac{1}{2}}\Rightarrow y=\frac{-\frac{1}{\sqrt{2}}}{\frac{\pi}{2}-\frac{1}{2}}\simeq 0.66$$

38. $A = \begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$

$\therefore$ The characteristic equation of A is $\lambda^2 - 10\lambda + 24 = 0$

$\therefore$ The Eigen values of A are $\lambda = 4, 6$

By property of Eigen values; we have

if λ be the Eigen value of $A \Rightarrow a_0\lambda^2 + a_1\lambda + a_2$ is the eigen

Value of $a_0A^2 + a_1A + a_2I$

$\therefore$ $\lambda = 4$ is the eigen value of $A \Rightarrow 3(4)^2 - \frac{1}{2}(4) + 3 = \frac{152}{3}$ is the eigen value of $3A^2 - \frac{1}{12}A + 3I$

$\lambda = 6$ is the eigen value of $A \Rightarrow 3(6)^2 - \frac{1}{12}(6) + 3 = \frac{221}{2}$ is the Eigen value of $3A^2 - \frac{1}{12}A + 3I$

40.

a[1]	a[2]	a[3]	a[4]	a[5]	a(6)	a[7]	a[8]	a[9]
(3)	(2)	(3)	(4)	(1)	(3)	(2)	(3)	(4)

Average $= \frac{\text{Comparision needed to find all 9 items}}{9} = \frac{25}{9} \cong 2.78$

42. $f_1 : x = -1, f(x) = 0;\ x = 0, f(x) = 0$

$\therefore$ not injective

Let $f(x) = 2$, then $x^2 + x = 2$ has no real solution in domain set. $\therefore$ not surjective

$f_2 : 2^{x_1} = 2^{x_2} \Rightarrow x_1 = x_2$ $\therefore$ injective.

There is no $x \in$ domain set such that $2^x = 3$ (for example) $\therefore$ not surjective

43. $R = \{(a,b) \in z \times z \mid a \equiv b \pmod n\}$ is equivalence relation for any n.

$(q_0, B) = (q_4, B, R)$

44. Suppose string is λ then $\downarrow$ is final State

Suppose string is ab then

$$\underset{q_0}{\downarrow} a\ b\ B \vdash B\ \underset{q_1}{\downarrow} b\ B \vdash B\ b\ \underset{q_1}{\downarrow} B \vdash B\ \underset{q_2}{\downarrow} b\ B \vdash B\ B\ \underset{q_3}{\downarrow} B$$

$$\vdash B\ \underset{q_1}{\downarrow} B\ B \vdash B\ B\ \underset{q_4}{\downarrow} B$$

$q_4 \longleftarrow$ Final state

46. T2 is rolled back in both basic timestamp and Thomas Write Rule.

47. Effective Access Time $=(1-p)*0.12+p*5000$ where p is the page fault rate

$1000=0.12-p*0.12+p*5000 \Rightarrow 999.88=p*4999.88 \Rightarrow p=19.99\%$

48. $p=\frac{1}{2}, n=18$

$\Rightarrow q=\frac{1}{2}$

$P(X\le 8)=P(X=0)+P(X=1)+....+P(X=8)$

$$=\left[{}^{18}C_o\left(\frac{1}{2}\right)^o\left(\frac{1}{2}\right)^{18-0}+{}^{18}C_1\left(\frac{1}{2}\right)^1\left(\frac{1}{2}\right)^{18-1}+...+{}^{18}C_8\left(\frac{1}{2}\right)^8\left(\frac{1}{2}\right)^{18-8}\right]$$

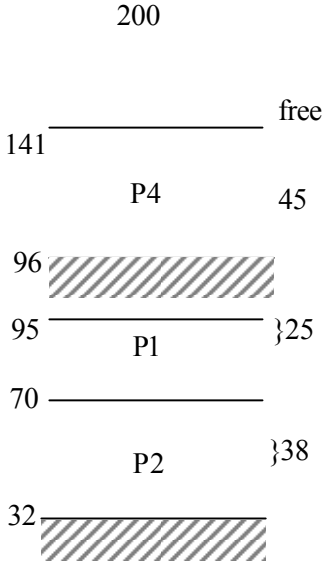
$\cong 0.04$

49. The level order traversals during insertion into max heap is
After inserting 42,23,37 →42, 23, 37,
After inserting 71 →71,42,37,23
After inserting 34 → 71, 42, 37, 23, 34
After inserting 51 → 71,42,51,23, 34,37
After inserting 9 → 71,42,51,23, 34,37,9

50.

1	5
2	1
3	2
4	3

51.



52. Value Expression = $(-1)^{s}(1.M)_2 \times 2^{E-127}$ (implicit normalization)

For getting the largest number we should take both Mantissa and Exponent maximum

$M_{max} = 1-2^{-23}$, $E_{max} = 254\ (1 \le E \le 254)$

Hence largest value is $\left(1+\left(1-2^{-23}\right)\right)\times 2^{254-127} = \left(2-2^{-23}\right)\times 2^{127}$

53. 52. $\underbrace{1}_{-ve}\ \underbrace{0\,1\,1\,1\,1\,1\,0\,1}\ \underbrace{1\,0\,0\,0\,0\,0\,0\,0\,0\,0\,0-----}$

Decimal equivalent

$= (-1)(1.\text{fraction}) \times 2^{\text{exponent}-\text{bias}}$

$= -(1.1) \times 2^{125-127}$

$= -1.5 \times 2^{-2} = -0.375$

54 . Blocking factor of data file $= \left\lfloor \frac{B}{R} \right\rfloor = \left\lfloor \frac{512}{50} \right\rfloor = 10$

Number of blocks needed for data file $= \left\lceil \frac{30000}{10} \right\rceil = 3000$

Size of index records = SSN + P = 4 + 6 = 10

Block factor of index file $= \left\lfloor \frac{512}{10} \right\rfloor = 51$

Number of first level index entries = number of data blocks = 3000 entries

Number of first level index blocks $= \left\lceil \frac{3000}{51} \right\rceil = 59$

Number of second level index entries = number of first level index blocks = 59

Number of second level index blocks $= \left\lceil \frac{59}{51} \right\rceil = 2$

Number of third level index entries = number of second level index blocks = 2

Number of third level index blocks $= \left\lceil \frac{2}{51} \right\rceil = 1$

Since the third level has only one index block, it is the top index level.

55. If n is order of B+ tree then

Max n child pointer

$(n-1)$ key &

O Record pointer (for non leaf node)

So $n*8 + (n-1)*10 \leq 1024$

$18n \leq 1034$

$n \leq 57.44$

$n \simeq 57$

Maximum key $n-1 = 57-1$

$= 56$