CHAPTER – 11

ROUTES / NETWORKS

Questions on Routes/Networks involve different points or locations between which there is some movement or communication. The way the movement or communication is effected is described in the data/conditions. Sometimes, these are also referred to as "Maps" because the routes given resemble a map.

The data given in these types of questions may not always have the word "route" or "network" in them but a network is indicated by some sort of connectivity between two "points." The way the statements are worded is important. The wording includes statements like

(i) Some poles are connected through wires.
(ii) Some towers send signals to one another.
(iii) Some cabins, market, cities, etc. are connected via. passages or roads and so on.

The connectivity between the two "points" can be only one-way or two-way. In one-way connectivity, the flow will be in only one direction whereas in two-way connectivity, the flow will be in both directions between the points.

Read the data carefully and then draw the diagram or network. The words "from" and "to" play an important role in these questions and hence, care should be taken while interpreting the data. While drawing a diagram, arrow marks can be used very effectively to indicate the direction of connectivity as explained below.

(i) If the statement mentions that there is a one-way route from city A to B then it can be represented as follows.

$$A \longrightarrow B$$

(ii) If the statement mentions that cities X and Y have roads on which you can travel in either direction, it means that it is a two-way connectivity. Then it can be represented as follows.
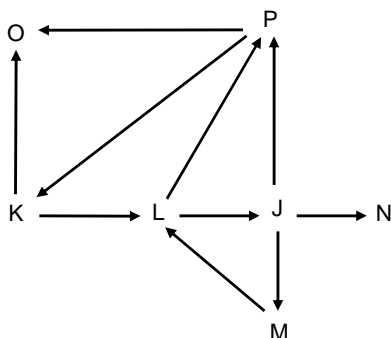
$$X \longleftrightarrow Y$$
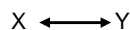
(iii) If the statement mentions that all the projected roads are one-ways and there is a route from point K to P and then from P to K, then it should be represented as follows.

$$P \rightleftarrows K$$
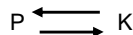
i.e., from P to K is one route and from K to P is another route.

Now, consider the following network.

In this network, let us say that a person starts from J and

he wants to reach K. We want to find out the number of distinct routes he can take without touching any point twice. Starting from J, the possible directions of movement are from J to N, J to M and J to P, but if he goes from J to N then coming back or travelling in some other direction is not possible. Hence, the person has only two options for movement from J (J to M and J to P). Now, if he goes to M, he has to go to L from M. At L, it appears that he has two options – he can go to P or to J. But, since he started from J and as he cannot touch any point twice, he cannot go to J. So, there is only one option at L – that is going to P. So, to reach P from J, there are two options – one directly to P from J and the other via. M and L. Once he reaches P, he has only one way of reaching K – along the diagonal PK. If he goes to O from P, then he cannot travel to K from O (the route is one way in the O to K). Thus the total number of ways from J to K is two (JPK and JMLPK).

Thus one has to look at all the possible routes carefully in the manner discussed above.

In the above example, if the route between J and L is two-way and then we have to find out the number of ways to reach O stating from J, the routes we have will be as follows:
JPO, JPKO, JMLPO, JMLPKO, JLPO, JLPKO

This gives us a total of six distinct ways of reaching O from J.

Directions for questions 1 to 5: These questions are based on the following information.

P, Q, R, S, T, U, V are seven places on a map. The following places are connected by two-way roads: P and Q; P and U; R and U; R and S; U and V; S and T; Q and R; T and V. No other road exists.

1. The shortest route (the route with the least number of intermediate places) from P to V is
    (A) P-R-V   (B) P-T-V
    (C) P-Q-R-U-V   (D) P-U-V

2. How many distinct routes exist from S to U (without touching any place more than once)?
    (A) 3   (B) 2   (C) 1   (D) 4

3. The route covering the maximum number of places and going from P to R does not pass through
    (A) U   (B) T   (C) S   (D) Q

4. If U to V and S to R are only one-way routes, then which of the following places lose contact with P?
    (A) V
    (B) T
    (C) S
    (D) No place loses contact with P

5. If the number of places to which a place is connected directly considered as the measure of importance, then which of the following places is of the highest importance?
    (A) Q   (B) P   (C) R   (D) S

Solutions for questions 1 to 5:

The route map of the places is as follows:
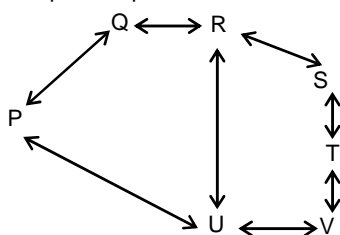
1. As is seen, P-U-V is the shortest way (with only one intermediate point) from P to V.   Choice (D)

2. To travel from S to U, the routes available are:
   S-R-U; S-T-V-U and S-R-Q-P-U – a total of 3 routes.
                                                      Choice (A)

3. First let us write down the route from P to R with the maximum number of intermediate points. By observation, we find that it is P-U-V-T-S-R. It does not touch Q.   Choice (D)

4. If U to V and S to R are only one-way routes, from the figure, we find that all places can still be reached from P. Hence, none of the places loses contact with P.   Choice (D)

5. For each of the places given in the choices, Q, P, R and S, let us see how many places are directly connected.
   Q is directly connected to 2 places.
   P is directly connected to 2 places.
   R is directly connected to 3 places.
   S is directly connected to 2 places.   Choice (C)

Directions for questions 6 to 9: These questions are based on the following information.

Five cities P, Q, R, S and T are connected by different modes of transport as follows:
P and Q are connected by boat as well as by rail.
S and R are connected by bus and by boat.
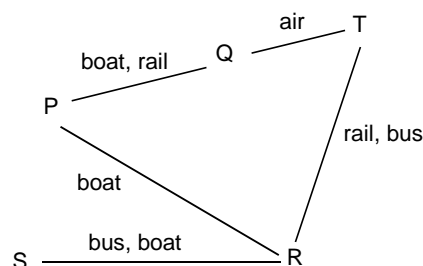Q and T are connected only by air.
P and R are connected only by boat.
T and R are connected by rail and by bus.

6. Which of the following pair of cities are connected by any of the routes directly [without going through any other city]?
   (A) P and T   (B) T and S
   (C) Q and R   (D) None of these

7. Which mode of transport would help one to reach R starting from Q but without changing the mode of transport?
   (A) Boat   (B) Rail   (C) Bus   (D) Air

8. If a person visits each of the places starting from P and gets back to P, which of the following places must he visit twice?
   (A) Q   (B) R   (C) S   (D) T

9. Between which two cities among the pairs of cities given below are there maximum travel options available? (If there is more than one route possible between two cities, consider the route with least number of cities enroute.)
   (A) Q and S   (B) P and R
   (C) P and T   (D) Q and R

Solutions for questions 6 to 9:

6.

P and T are connected through Q.
T and S are connected through R
Q and R are connected through T or P. Q and S are connected through R and P or T. So none of the pairs in the choices are directly connected.
                                                      Choice (D)

7. From Q to P, he can reach by boat.
   From P to R also he can travel by boat.
   So, a person should travel by boat to reach R from Q without changing the mode of transport.
                                                      Choice (A)

8. If a person wants to visit all the places and again return to P, then he can go in the order of
   P→ Q → T → R → S and then
   S → R → P (OR)
   P → R → S and then
   S → R → T → Q → P
   He must visit R twice.   Choice (B)

9. One has to travel between any of the two cities with a restriction that if there is more than one possible route, he has to go by the least number of cities enroute. It is better to take the pair of cities given in each of the choices.

   Choice (A) Q and S: A person can go from Q to T to R to S (or) Q to P to R to S or vice-versa. In both the routes, there are two cities enroute. We can calculate the number of options in the entire route by multiplying the options available in each segment of the route.
   For the route Q-T-R-S, the number of options
   $= 1 \times 2 \times 2 = 4$
   For the route Q-P-R-S, the number of options
   $= 2 \times 1 \times 2 = 4$

   Choice (B) P and R: The route between P and R has only one mode of travel, that is boat.

   Choice (C) P and T: A person can go by PQT in either way or by PRT in either way. If it is by PQT, then the options are boat-air or rail-air i.e. two ways. If it is by PRT, then the options are boat-rail or boat-bus in either way. Hence, they are only two options.

   Choice (D) Q and R: If a person travels between Q and R, then he can go by QTR or by QPR. If he goes by QTR, then the options are air-rail or air-bus, that gives two options or if he goes by QPR, then the options are rail-boat or boat-boat, that will again give us two options.

   So, it is very clear that Q and S have maximum number of travel options available between them.
                                                      Choice (A)

10. Four computers P, Q, A and B are interconnected for the transmission of data. A and B can each send data to both P and Q but B cannot receive data from A. P and Q can have data flow in both directions between them but they cannot transmit the data so received to B but can otherwise send the data directly to B. Which of the following routes can be followed if B has to receive data from A?

I.   AQPB   II. APB
III. AQB   IV. APQB

(A) I and III   (B) II and III
(C) III and IV   (D) All four

Solution for question 10:

10. AQPB and APQB can be eliminated because P and Q cannot send the data to B.
The paths AQB and APB do not violate any conditions and hence can be possible routes to send data from A to B.   Choice (B)

Exercise – 11(a)

Directions for questions 1 and 2: Select the correct alternative from the given choices.

1. Seven cities A, B, C, D, E, F and G are connected as follows. One-way routes are between A to B and C; B to C, B to E and D; D to E and F; F to G; E to G. Two-way routes are between C and D and between E and F. Total how many routes are possible, if a person wants to go from A to G without going through E and not going through any city more than once?
(A) 3   (B) 6   (C) 4   (D) 5

2. Five cities - Ahmedabad, Bangalore, Calicut, Delhi and Indore are connected by one way routes from Ahmedabad to Bangalore, Delhi to Ahmedabad, Indore to Delhi, Delhi to Calicut, Ahmedabad to Calicut, Bangalore to Calicut, Calicut to Indore, Indore to Bangalore and Ahmedabad to Indore.
In how many ways a person can travel from Delhi to Indore without visiting any city more than once?
(A) 5   (B) 3   (C) 6   (D) 4

Directions for questions 3 to 5: These questions are based on the following information.

Nine cities A through I are connected by different railway routes as follows.
There is a one-way route from A to B, C to I, E to G, A to D, F to D, G to H, A to E, H to B, D to G, E to H, C to F, B to I and A to C.
There is a two-way route from F to I. The distance between A and B, C and I, E and G, A and D, A and E, E and H, C and F, A and C is 50 km each whereas the distance between F and D, G and H, D and G, H and B, B and I, F and I is 100 km each.

3. What is the distance from A to I through E?
(A) 300 km   (B) 400 km
(C) 350 km   (D) Data inadequate

4. What is the length of the longest possible route from C to B?
(A) 550 km   (B) 450 km
(C) 400 km   (D) 600 km

5. In how many ways can a person travel from A to I, without passing through any city more than once?
(A) 8   (B) 7   (C) 9   (D) 6

Directions for questions 6 and 7: These questions are based on the following information.

Eight cities A through H are connected in such a manner that the routes from F to A, A to E, E to F, C to E, E to H, H to C, H to D, E to D, B to E, G to B, A to B and G to A are one way routes, and the routes between F and C, H and G, D and B, F and G are two way routes while travelling from one city to other one should not visit any city more than once.

6. Among the following which city one must visit while traveling from A to H?
(A) B   (B) E   (C) D   (D) G

7. At most how many intermediary cities one can visit while travelling from G to F, not visiting any city more than once?
(A) 4   (B) 5   (C) 3   (D) 6

Directions for questions 8 to 10: These questions are based on the diagram given below.

Eight different cities A through H are, connected by different modes of transport and all are two-way connections, while travelling from one city to other one should not visit any city more than once.
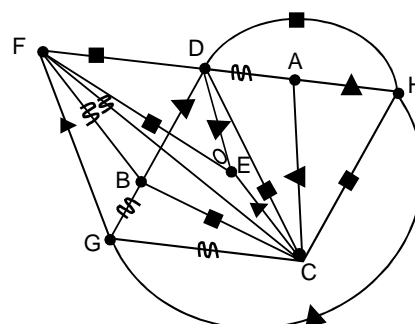
Modes of transports:
- ■ — By train
- ▲ — Road
- ᴧᴧ — Air

8. Which is the only mode of transport that would help one to reach from G to D?
(A) Train   (B) Air
(C) Road   (D) None of these

9. At most how many intermediary cities one can visit while traveling from G to F by using exactly two modes of transport?
(A) 3   (B) 4   (C) 5   (D) 6

10. At most how many intermediary cities one can visit while traveling from C to F by using exactly one mode of transport?
(A) 2   (B) 3   (C) 4   (D) 5

Directions for questions 11 and 12: These questions are based on the following information.

A soldier is being instructed on his cord-less phone. He has to follow the instructions to reach the desired place. There are eight types of instructions which are as follows:
Instruction A -   East, 120 m
Instruction B -   North-east, 100 m
Instruction C -   West, 20 m
Instruction D -   South-west, 100 m
Instruction E -   North, 30 m
Instruction F -   North-west, 100 m
Instruction G -   South, 130 m
Instruction H -   South-east, 100 m

Note: Here, North-east means 45° North and 45° East. The same applies for South-west, North-west and South-east.

11. If the instructions given to the soldier are CECEA, how far is he from his starting point?
(A) 100 m   (B) 120 m   (C) 140 m   (D) 160 m

12. Which of the following set of instructions will take him the farthest?
(A) DFB   (B) FDH   (C) BHB   (D) BHD

Directions for questions 13 and 14: Select the correct alternative from the given choices.

13. Five friends – A, B, C, D and E – have to send some messages to each other subject to some restrictions. A can send messages to B, C and D, all of whom can send messages to E. Also, (A and E), (B and C) and (C and D) can send messages to each other. In how many different ways can A send a message to E. (No person's name should be repeated in a single message sending sequence)?
(A) 6   (B) 8   (C) 10   (D) 12

14. Eight cities O, P, Q, R, S, T, U, V are connected with one-way and two-way roads as follows. One-way roads are from:
P to Q; Q to R; S to O; O to Q; S to U, T to U; T to R; U to V; V to T; Q to S.
Two-way roads are between P and R; S and T.
It takes 2 days to travel from one city to another using a one-way road and it takes 1 day in case the cities are connected by a two-way road. What is the minimum number of days required by a man to go from P to V and return to P, passing through S both the times?
(A) 14   (B) 13   (C) 16   (D) 15

Directions for questions 15 to 17: These questions are based on the following information.

Five cities – A, B, C, D and E are connected by a network of roads. All the roads are either one way or two way. The network of roads is as follows.

1. When names of the cities are arranged in alphabetical order, then each city can be visited directly from each of the cities which occur before it.
2. Only 2 pairs of cities are connected by 2 way roads.
3. No two cities with names that are named by adjacent alphabets are connected by 2 way roads.
4. There is no direct road from E to A.
5. Each city can be visited from every other city either directly or through intermediary cities.

15. If the minimum number of cities that can be visited while travelling from E to B is two, then the cities connected by the two way roads are
(a) E and C   (b) D and B   (c) E and A
(A) only (a)   (B) Both (a) and (b)
(C) Both (b) and (c) (D) Both (a) and (c)

16. If there is a two way road between B and D, then the other two way road is in between
(A) C and A
(B) D and A
(C) E and B
(D) Such situation is not possible.

17. If the road connecting E and B is not a two way road and the two way roads have no city in common, then the number of different routes from B to A is
(A) 1   (B) 3   (C) 2   (D) 4

Directions for questions 18 to 20: These questions are based on the following information.

Seven cities Aland, Bali, Chambal, Deccan, Eluru, Fatehpur and Garwa are connected by the following network of roads. While travelling from one city to another, no intervening city should be visited more than once.

One-way roads are from Aland to Eluru and Garwa; from Bali to Chambal and Fatehpur; from Chambal to Garwa and Fatehpur; from Deccan to Eluru and Bali; from Eluru to Chambal; from Garwa to Fatehpur; and from Fatehpur to Aland.

Two way roads are from Aland to Bali; from Bali to Eluru and from Deccan to Garwa.

18. The number of different routes to travel from Chambal to Deccan is
(A) 1   (B) 2   (C) 3   (D) 4

19. What is the maximum number of cities that can be visited while travelling from Garwa to Chambal?
(A) 3   (B) 4   (C) 5   (D) 6

20. If the 2 way roads are not used, then in which of the following routes one can travel?
(A) Aland to Bali   (B) Fatehpur to Bali
(C) Deccan to Aland   (D) None of the above

Directions for questions 21 and 22: These questions are based on the following information.

Shown below is the layout of the major cities of a state and the rail tracks, connecting those cities.
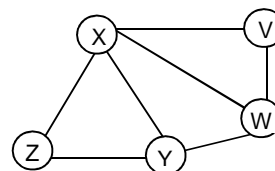
Five trains – T_1, T_2, T_3, T_4 and T_5 run only on two days (Saturday and Sunday), along the following routes, between these cities.

T_1 : Y – X – V T_2 : Z – Y – X – V
T_3 : Z – Y – W – V T_4 : Z – X – W – V
T_5 : Z – X – W

Route Y – W cannot be used on Sunday. On any day, no two trains are scheduled to run on the same track connecting two adjacent cities.
Each train should run exactly once in these two days.

21. T_4 can run
   (A) only on Saturday
   (B) only on Sunday
   (C) on either day
   (D) only if W – Y route is used on Sunday.

22. Which of the following is NOT true?
   (A) T_2 and T_4 can be scheduled to run on the same day.
   (B) T_5 cannot be scheduled to run on Sunday.
   (C) T_3 can be scheduled to run on Saturday.
   (D) T_4 and T_1 can be scheduled to run on the same day.

Directions for questions 23 to 25: These questions are based on the following information.

The following sketch shows the pipelines carrying material from one location to another. Each location has some demand for material. The demand at C is 20 units, at E is 30 units, at B is 40 units and at D is 80 units. Each arrow indicates the direction of material flow through the pipeline. The flow from B to C is 50 units. The quantity of material flow is such that the demands at all these locations are exactly met. The capacity of each pipeline is 100 units.
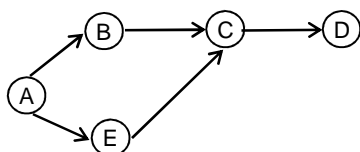
23. The quantity (in units) moved from E to C is
   (A) 80   (B) 50   (C) 100   (D) 60

24. The free capacity available in the A – B pipeline is
   (A) 20 units   (B) 90 units
   (C) 10 units   (D) 0 units

25. The free capacity available in the A – E pipeline is
   (A) 20 units   (B) 80 units
   (C) 10 units   (D) 0 units

Directions for question 26: Select the correct alternative from the given choices.

26. There are eight cities – A, B, C, D, E, F, M, N – which are connected by roads to each other, as described below:
   (One-way routes): A to B, C to E, M to B, E to F, D to B, B to C, A to M, A to N.
   (Two-way routes): M and D, N and F, C and D, C and N, N and E. What is the total number of routes by which city F could be reached from A, such that no city is visited twice in any route?
   (A) 10   (B) 19   (C) 23   (D) 15

Directions for questions 27 to 30: These questions are based on the following information.

There are eight important divisions in a city named A, B, C, D, E, F, G and H.
They are connected as follows:
Two way roads are between A and C, E and H.
One way roads are from A to B, B to G, B to C, G to F, G to D, C to H, C to G, D to C, D to F, D to H, E to D and F to E.
Rohit has to go through these divisions because his home is in A, college in C, gym in B, ground in G, coaching class in E, hotel in F, cinema hall in H and bakery in D.

27. If Rohit has to go to coaching class from his home, then what is the minimum number of intermediate divisions he has to go through?
   (A) Three   (B) Two   (C) Four   (D) Five

28. If Rohit wants to go to the hotel from home, without touching G, then what is the maximum number of intermediate divisions he can go through, such that he does not go through any of them more than once?
   (A) 5   (B) 3   (C) 4   (D) 6

29. A division is considered to be having more importance than the other, if it is directly connected to more number of divisions. What is/are the most important division/s in the city?
   (A) C and D (B) G   (C) C   (D) F

30. Which of the following routes has the smallest number of intermediate divisions?
   (A) Gym to the hotel.
   (B) Coaching class to the ground.
   (C) Home to the coaching class.
   (D) Home to the hotel.

Exercise – 11(b)

Directions for questions 1 to 3: These questions are based on the following data.

Eight railway stations A through G are connected either by two-way passages or one-way passages.
One way passages are from C to A, E to G, B to F, D to H, G to C, E to C, and H to G.
Two-way passages are between A and E, G and B, F and D and D and E.

1. What is the least number of stations through which a train passes while travelling from B to A?
   (A) 2   (B) 3   (C) 4   (D) 5

2. Which of the following routes, if travelled through least possible number of intermediary stations, has

the maximum number of intermediary stations?
   (A) F to A   (B) B to C
   (C) G to A   (D) H to E

3. If the route between G and C is closed, which of the following stations need not be passed through while travelling from H to C?
   (A) D   (B) A
   (C) E   (D) B

Directions for questions 4 to 7: These questions are based on the following information.

A oneway river channel network from X to Y is given below, where arrows represent the direction in which the boats can travel between two bays. The number on the

arrow represents the time in minutes required to travel the length of the bay.
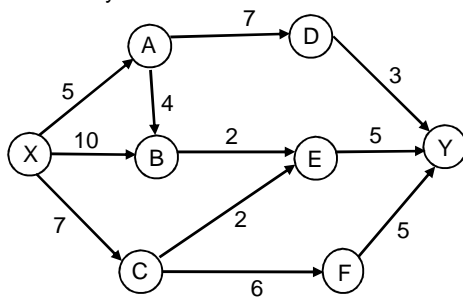
The boats are allowed to travel in any route. The commuter will take the boat, which takes least time to travel from X to Y. The channel network authority can control the boat traffic by increasing or decreasing the halting time at the bays. A, B, C, D, E and F are the bays in between X and Y.

4. If the halting time at any bay is the same, then what is the first bay that a commuter will reach?
(A) A
(B) B
(C) C
(D) Either (A) or (B)

5. If the channel between A and D is under repair, how the authority can change the halting time (in minutes) at the bays A, B, C, E and F to ensure that the traffic is same in all routes?
(A) 1, 0, 3, 4, 0
(B) 1, 1, 4, 5, 0
(C) 1, 1, 4, 3, 1
(D) 1, 0, 5, 6, 1

6. What can be the halting time (in minutes) at A, B, C, D, E and F made by the authority to ensure that equal number of boats will travel through X → A, X → B and X → C?
(A) 2, 1, 4, 2, 1, 1
(B) 2, 1, 1, 2, 1, 1
(C) 1, 0, 2, 1, 0, 0
(D) 1, 0, 2, 4, 0, 3

7. If the halting time at any of the bays – A, B, C, D, E and F is exactly one minute more than the halting time at the immediately previous bay (the halting time at X is considered to be zero minutes) of the specified route, then which of the following pairs of routes has a travel time difference of exactly three minutes?
(A) X → A → D → Y and X → C → F → Y
(B) X → C → F → Y and X → A → B → E → Y
(C) X → A → B → E → Y and X → C → E → Y
(D) X → C → E → Y and X → A → D → Y

Directions for questions 8 to 10: These questions are based on the diagram given below:

Five cities P, Q, R, S and T are connected by one way rail routes as shown below. One takes one hour duration to travel between any two directly connected cities.
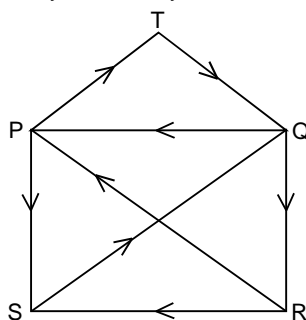
At station S, for every 2 hours one train departs and the departure time of the first train is 6:00 a.m. Similarly at station R, for every 3 hours one train departs and the departure time of the first train is 4 a.m.
At station Q, one train departs for every 2 hours and the departure time of the first train is 7 a.m.
At station P, train departs for every 1 hour and the departure time of the first train is 8 a.m.
At station T, for every 3 hours one train departs and the departure time of the first train is 5:30 a.m.

8. If a person reaches Q at 1:00 p.m. from R, then at what time he must have started from R if that person takes the shortest route?
(A) 10:00 a.m.
(B) 9:00 a.m.
(C) 11:00 a.m.
(D) None of these

9. A person wants to travel from R to T and he takes the longest route without visiting any station more than once. If he starts at 4:00 a.m. then for how much time he has to wait for the trains altogether in all stations before reaching T.
(A) 2 hours
(B) 3 hours
(C) 2 hours
(D) 1 hour

10. If a person starts from P at 10:00 a.m. to reach S and he takes the longest route, then at what time will he be reaching?
(A) 1 O'clock
(B) 4 O' clock
(C) 5 O'clock
(D) 2 O'clock

Directions for questions 11 to 14: These questions are based on the following information.

Ten friends Tippy, Tappy, Tangy, Timmy, Tango, Tony, Tommy, Tweety, Toby and Tenny have wireless systems in their playhouse. There are three kinds of message transfer modes between them, namely
(i) only sending messages,
(ii) only receiving messages, and
(iii) both sending and receiving messages.

The only message sending modes (and the only message receiving modes) are as follows :
Tweety to Timmy, Toby to Tangy, Tappy to Tony, Tangy to Tippy and Tony, Tony to Tenny, Tango to Toby, Tommy to Tony, Tony to Tango.
The message sending and receiving modes are as given below:
Tangy and Timmy, Toby and Tappy, Tango and Tommy, Tippy and Tweety, Tenny and Tommy.

11. If Tenny wants to send a message to Tippy, then through how many least number of other persons must the message pass?
(A) 6
(B) 5
(C) 4
(D) 3

12. In which of the following choices can all the ten persons be included, (without repeating any person) while sending the message?
(A) Tenny to Toby
(B) Tony to Tweety
(C) Tango to Timmy
(D) Tippy to Tappy

13. If Tony goes on a holiday, then in which of the following choices is it not possible for a message to be sent from the first person to the second given that the message can be passed through any person only once?
(A) Tommy to Timmy
(B) Tango to Tweety
(C) Tangy to Toby
(D) Tenny to Tappy

14. If all the one-way message-sending routes reverse (e.g., Tweety to Timmy now becomes 'Timmy to Tweety', and so on), then which of the following message sending sequences will include all the ten persons?
(A) Tenny to Timmy   (B) Toby to Tweety
(C) Tappy to Tippy   (D) Tony to Tommy

Directions for questions 15 to 17: These questions are based on the following information.

The following diagram indicates the network of one-way pipes through which three water tanks – P, Q and R are connected to a source S.
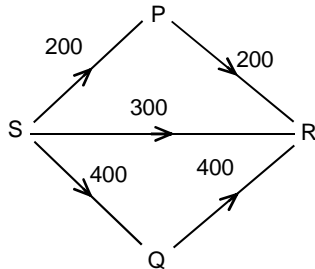

The capacities of the tanks – P, Q and R are 800 litres, 1000 litres and 1200 litres respectively. The number above a line indicate the quantity of water (in litres) that flows per hour through each of the pipes and the arrow heads indicate the direction of water flow. Water flows in the pipes till R is filled completely. Water flows out of a tank only after the tank is filled completely. The flow of water starts only when P, Q and R are empty.

15. Which of the following statements is true?
(A) R gets filled completely at the same time when P is full.
(B) P gets filled completely fifteen minutes after R is full.
(C) P never gets completely filled.
(D) More than one of the above.

16. If the direct pipe to R from S is closed and 300 litres of water flows per hour from S to P as well as from P to R, what will be the quantity of water in tank P, when Q is completely filled?
(A) 600 litres   (B) 675 litres
(C) 700 litres   (D) 750 litres

17. If the pipes connecting S to P and P to R are closed and water starts flowing out of S at 6 am, then what is the earliest time when R gets completely filled?
(A) $9:05\dfrac{13}{60}$ am   (B) $9:08\dfrac{4}{7}$ am
(C) 9:30 am   (D) $9:37\dfrac{1}{12}$ am

Directions for questions 18 to 21: These questions are based on the following information.

In the city XYZ, P is a water source from where water flows into the tanks – Q, R, S, T and U. The following diagram shows the network of the source and all the five tanks connected with pipes through which water flows.
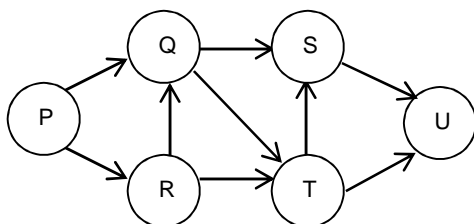
For any pipe, *flow* is the number of units of water flowing through it. For any tank, *capacity* is the number of units of water that the tank holds.

The following information is also known.

(i) The *capacity* (in units) of each of the five tanks given as well as the *flow* (in units) in each of the nine pipelines given is positive integral value less than 10.
(ii) The *flow* (in units) of each of the pipelines connected to any tank is different except for the pipeline connecting Q and S. Further, none of them is equal to *capacity* (in units) of that tank.
(iii) The difference in the *capacities* of R and T is 1 unit.
(iv) The *capacity* of Q is more than that of exactly two tanks.
(v) The sum of the *capacities* of all the five tanks is 17 units.
(vi) The *flow* in the pipeline connecting Q and T is 4 units and the *flow* in the pipeline connecting T and U is 2 units.
(vii) U has the highest *capacity*.

18. Find the *flow* in the pipeline connecting R to Q.
(A) 1 unit   (B) 2 units
(C) 3 units   (D) Cannot be determined

19. Find the *flow* in the pipeline connecting R to T.
(A) 5 units
(B) 6 units
(C) 7 units
(D) Cannot be determined

20. Find the *capacity* of U.
(A) 5 units
(B) 6 units
(C) 7 units
(D) Cannot be determined

21. Find the combined *capacity* of the two tanks S and U.
(A) 9 units
(B) 10 units
(C) 11 units
(D) Cannot be determined

Directions for questions 22 and 23: These questions are based on the following information:

Eight cities – A, B, C, D, E, F, G and H are connected as follows: There is a two-way road from A to C of length 300 km. E and G are connected by a two-way road of length 500 km. Similarly, F - G, A - H and C - F are connected by two - way roads of lengths 300 km, 200 km and 400 km respectively. One way roads from H to B, D to E, C to H, B to F, G to D, E to C are of lengths 400 km, 700 km, 500 km, 600 km, 1000 km, 1100 km respectively.

22. What is the minimum distance to travel from D to H?
(A) 2200 km   (B) 2300 km
(C) 2400 km   (D) 2100 km

23. If a person wants to travel a maximum of 1700 km starting from H, what is the maximum number of cities that he can cover excluding H?
(A) Six   (B) Four
(C) Five   (D) Three

Directions for questions 24 to 27: These questions are based on the following information.

A, B, C, D, E and F are close friends. A has a chocolate factory and he distributes some chocolates to his friends and his friends distribute the chocolates among themselves as shown.
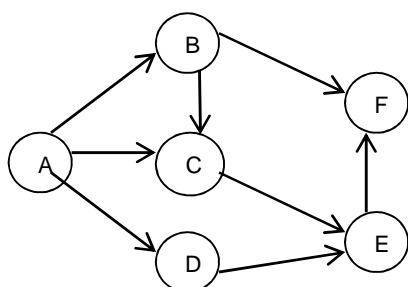
The following information is also known.

1. No person receives the same number of chocolates from two different persons.
2. After the distribution, each person has a different number of chocolates, which are consecutive natural numbers.
3. No person gives the same number of chocolates to two different persons.
4. The number of chocolates with C after the distribution is 4 and that with A is the least.
5. A gives six chocolates to D and C gives one chocolate to E.
6. The number of chocolates with F is twice that with E.
7. No person gives more than 10 chocolates to any other person.
8. At least one chocolate is passed between two persons who are connected in the network.

24. What is the total number of chocolates with A before distribution?
(A) 25   (B) 27   (C) 33   (D) 21

25. The number of chocolates with D after distribution is
(A) 2   (B) 3   (C) 5   (D) 7

26. The number of chocolates given by A to C is
(A) 3   (B) 4   (C) 8   (D) 6

27. The total number of chocolates with A, B and D after distribution is
(A) 4   (B) 2   (C) 8   (D) 6

Directions for questions 28 to 30: These questions are based on the following information:
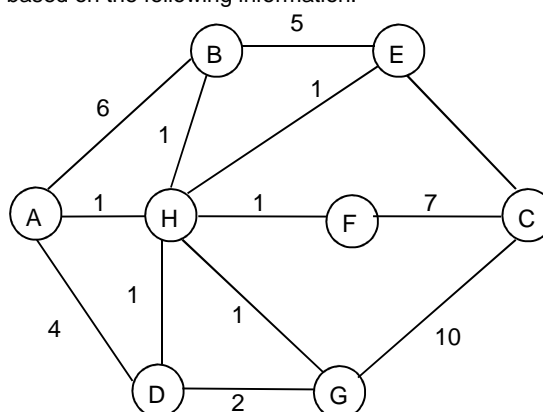
A through H are eight cities connected by two way routes as shown in the above figure. The numbers above the line indicate the cost incurred for travel.

A person coming to H can only visit certain cities depending on the city from which he/she came to H as given in the following table.

Visitors arriving from	Visitors can further travel only to
A	D and G
D	B, E and A
G	B and A
B	A, E and G
E	D and F
F	A, B, E, D, G and F

Directions for questions 28 to 30: Write your answer in the box provided below the question.

28. If the road between G and C, and B and E is closed, what is the minimum possible number of visits to city H for a person to travel to all the cities at least once?

29. What is the MINIMUM cost incurred for a person to travel from A to E?

30. What is the MINIMUM cost incurred for a person to travel from D to G?

Key

Exercise – 11(a)

1. A	6. B	11. A	16. D	21. B	26. B
2. D	7. B	12. C	17. B	22. D	27. B
3. D	8. C	13. C	18. B	23. B	28. A
4. A	9. D	14. D	19. C	24. C	29. A
5. B	10. B	15. D	20. C	25. A	30. A

Exercise – 11(b)

1. A	6. A	11. C	16. D	21. C	26. B
2. D	7. A	12. D	17. B	22. B	27. C
3. B	8. A	13. C	18. A	23. C	28. 1
4. C	9. D	14. C	19. B	24. D	29. 4
5. A	10. C	15. C	20. D	25. A	30. 2