IIT KHARAGPUR
DEPARTMENT of COMPUTER SCIENCE & ENGINEERING
END-SEMESTER EXAMINATION
SMARTPHONE COMPUTING & APPLICATIONS (CS 60009)
(Answer as many as you can)
FULL MARKS- TBD TIME – 3 hrs

1. (a). When the WiFi interface is enabled, users moving along the road hear WiFi access points (APs) from nearby buildings. Each WiFi sample corresponds to the list of APs MAC addresses and their corresponding RSS values. Cellular and WiFi anchors correspond to points in the RSS signal space with unique signature. Let there be 4 WiFi samples and the RSS(in dBm) corresponding to the APs are provided in the table below for each sample. Calculate the distance between each pair of samples.

(b) Draw a finite state mealy machine showing how a tunnel can be detected.

samples	AP_1	AP_2	AP_3	AP_4	AP_5	AP_6	AP_7	AP_8
S_1	-20	-35	0	-40	-50	0	-20	-15
S_2	-30	0	-25	-20	-25	-10	0	0
S_3	0	-25	-45	0	-30	-15	-45	-20
S_4	-20	-30	-30	-20	0	-10	-20	-25

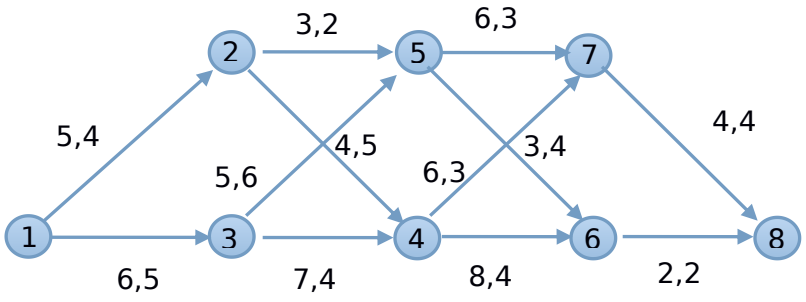
(4+3)

2. In a mobile cloud scenario a task is either executed in the device itself or is offloaded to the cloud for execution. Task flow is assumed to be linear and each task is associated with an energy and a time required for its execution. The aim is to obtain a task execution flow such that the delay constraint is maintained and the energy consumed is minimum. This problem can be represented as a constrained shortest path problem. Below is an algorithm which gives a lower bound for the optimal solution. Fill in the gaps to complete the algorithm. S and D are the source and destination node. T_d is the time deadline. e represents cost and d represents delay. **λ is the lagrangian multiplier.** e(P) is the energy cost associated with path P. d(P) is the delay associated with path P.

Algorithm 1: Finding e_λ minimum task scheduling policy for collaborative execution

Input: S, D and T_d
Output: p_λ^*
p_e=**ShortestPath**(S, D, e)
if(——-) then
  return p_e
end if
p_d=**ShortestPath**(S, D, d)
if(——-) then
  return "There is no feasible solution"
end if
while true do $\lambda = \frac{e(p_e)-e(p_d)}{d(p_d)-d(p_e)}$
  p_λ=**ShortestPath**(S, D, e_λ)
  if(——-) then
    return p_d
  else
    if(——-) then
      $p_d = p_\lambda$
    else
      $p_e = p_\lambda$
    end if
  end if
end while

(b) Given the task execution flow graph (cost, time) check whether a feasible solution exists (between 1 and 8) . The time deadline is 13.



(4+4)

3. Consider the matrix given below where an entry (i,j) represent the distance between i and j. If we consider the least-action-trip planning algorithm and the next vertex is chosen based on the weight function $1/d^a$, where d is the distance between the current vertex and an unvisited waypoint and a=1, calculate the total distance traveled before all nodes are traversed starting from p_1. If entry i,j is ∞ then assume i and j to be disconnected.

	p_1	p_2	p_3	p_4	p_5	p_6	p_7	p_8	p_9
p_1	-	7	5	9	∞	∞	∞	∞	4
p_2	7	-	4	6	5	∞	8	∞	10
p_3	5	4	-	∞	9	6	8	∞	∞
p_4	9	6	∞	-	∞	5	∞	8	4
p_5	∞	5	9	∞	-	5	∞	7	∞
p_6	∞	∞	6	5	5	-	∞	6	10
p_7	∞	8	8	∞	∞	∞	-	9	∞
p_8	∞	∞	∞	8	7	6	9	-	∞
p_9	4	10	∞	4	∞	10	∞	∞	-

(6)

4. A node u needs to download a file of size 800 KB and is initiating a collaborative download scheme. The cost it is willing to incur is 400 units.There are 8 nodes (v_1,v_2,...,v_8) in the system. Let the node u initiate the group formation protocol at time t=0 and wait till t=20 to form the group for collaboration. The nodes v_1,v_2,...,v_8 broadcast I-am-alive packets at intervals t_i (provided in the table below) starting at t=0 (no message is transmitted at t=0). u then performs a threshold based group selection criteria and is followed by work-queue algorithm which starts at t=25. The file is distributed into chunks each of size 100 KB. Which nodes will be selected for collaboration? Determine the time required to download the whole file and the cost associated. The bids of the nodes are given below

	Bid	WWAN speed	t_i
V_1	0.4 units/kB	25 kB/sec	5
V_2	0.8 units/kB	20 kB/sec	10
V_3	0.3 units/kB	10 kB/sec	15
V_4	0.4 units/kB	2 kB/sec	25
V_5	0.2 units/kB	5 kB/sec	30
V_6	0.1 units/kB	1 kB/sec	25
V_7	0.6 units/KB	4 KB/sec	15
V_8	0.4 units/KB	20 KB/sec	5

(3+5)

5. Describe cross-site scripting in 3 lines? How can augmented reality browsers be used in large-scale automatic tracking? (write in 3 lines)

(2+3)

6. a. What is a “Traffic Marker” in the context of Tessellation? Give example of two popular traffic-markers.

(2+1)

b. Suppose, there are 3 session-blocks S1, S2 and S3. Each one has duration of 10 units. The user traffic-marker pairs for each session is

S1={(u1,m1),(u2,m2)} S2={(u1,m3)(u2,m1)}
S3={(u3,m1)}

i) Calculate the uniqueness of the (u1,m1) pair and (u1,m3) pair.

ii) For each of the pairs calculate the persistency if it is possible or justify if calculating persistency is not possible for that pair.

(2+2)+(2+2)

c. What do you mean by activity fingerprint of a user?

(2)

d. Suppose, a user u has activity fingerprint F={a1,a2,a3}. There are 3 other users u1, u2 and u3. The lists of services used by each of them are

S1={a1,a2,a3,a4}
S2={a2,a3,a4,a5}
S3={a1,a2}
Calculate the uniqueness of fingerprint F.

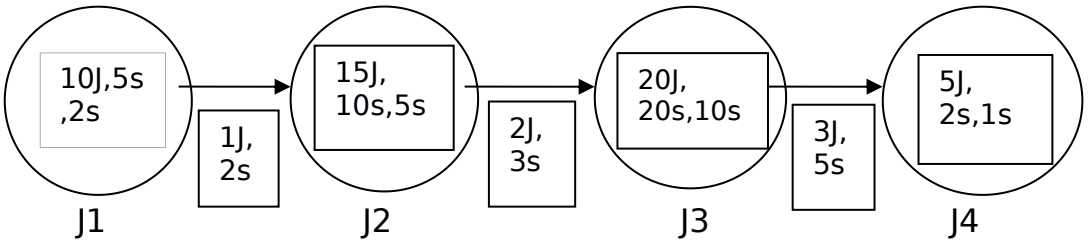
(3)

7. What are the 4 broad categories of mobility models in Mobile Ad hoc Network? (2)

8. a) In case of MAUI, what are the 3 types of codes which should never be marked as “remoteable”?

(3)

b)



Assume that for an APP J1, J2, J3 and J4 are four subroutines which should be invoked sequentially and each one depends on previous one’s results.

For each sub-routine vertex there are three values – the energy it takes to execute it locally, the time it takes to execute it locally and the time it takes to execute it at the MAUI server. For example, for J1, it takes 10J energy and 5s time to execute it locally and 2s time to execute it at the server. Each edge is marked with the transfer (transferring the state to MAUI server) energy and transfer time from/to MAUI server. Only J2 and J3 are marked as remoteable sub-routines

i) Given the constraint that the total time to execute this 4 sub-routines must be less than L, formulate (with 2-3 lines explanation) the 0-1 integer linear programming (ILP) problem which has to be solved by the MAUI solver to decide whether to offload any sub-routine or not. You need not simplify or solve it.

(4)

ii) Calculate the time and energy spent, if the solver decides to

I) offload none of J2 and J3 and
II) offload both J2 and J3 (4)