IIT Kharagpur
SMARTPHONE COMPUTING
and
APPLICATION (CS60009)
Mid-semester Examination (Fall 2016-2017)

Duration: 2 Hrs **FM: TBD**

1. Answer all questions **[5x2=10]**

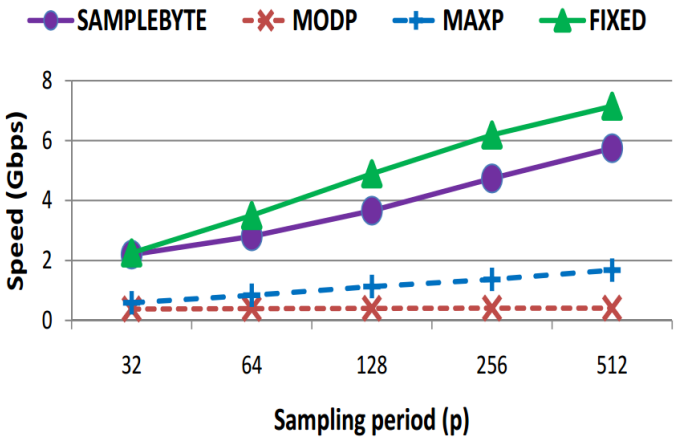
   (a) What is Persuasive Technology? Give an example.

   (b) With respect to sensing draw the query tree for the following:
   (($AVG(A,5) < 70$ AND $MAX(B,4) > 100$) OR ($C < 3$ AND $Speed(D,2) < 1.0$))
   AND (($STD(S,5) < 70$ OR $MODE(M,7) > 80$) AND ($Z < 3$ OR $Height(H,7) > 90$))

   (c) With respect to Android development, briefly mention the difference between dp and sp.

   (d) When would you use (i) a Spinner and (ii) a Radio Button during development of an Android app?

   (e) Consider the following graph representing average processing speed variation with sampling period for Max-Match in EndRE.

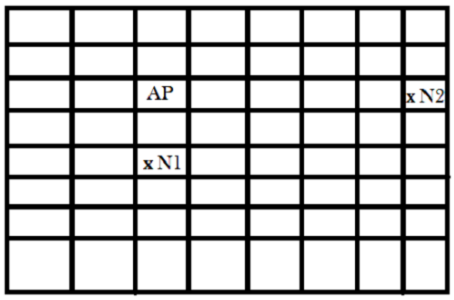


   i. Which algorithm out of the 4 shown above is the least sensitive to variation in sampling period? Which one is the most sensitive?

   ii. At what sampling period value does SAMPLEBYTE reach the same efficiency that FIXED achieves at a sampling period of 2^8?

2. (a) Use the Seidel & Rappaports formulae to estimate the signal strength of WiFi access-point AP at mobile receivers N1 and N2. All black lines are walls.
   N1 is at a distance of 28 meters from AP. N2 is at 45 meters distance from AP. At 1 meter distance (d0) from the AP, its strength is −25dBm. Wall Attenuation factor (WAF)= 3 dBm. The maximum number of walls up to which attenuation factor makes a difference is 3. The rate at which power attenuates with distance (n) is 2.

   i. Write the Wall Attenuation formulae in terms of P(d0),n,WAF and C. Also write what these symbols stand for. **[2]**



ii. Calculate signal strengths at N1 and N2 **[4]**

(b) *"Using the synchronized timestamps, we merged all of the traces collected during the off-line phase into a single, unified table containing tuples of the form (x,y,d,ss_i,snr_i), where $i \in 1, 2, 3$ corresponding to the three base stations."*
What does x,y,d,ss_i,snr_i stand for in this statement? **[4]**

3. Consider a hypothetical Fitness Tracking Application that seeks to detect a query Q: *"Take pushups for* 12 *minutes while exposed to an ambient temperature greater than* 25 *Degree C (over a* 15 *minutes window) and exhibit an average pulse rate (over* 5 *minute window) of* $>$ 80 *beats/min"*.

Assume that this application uses an external wrist worn device, equipped with accelerometer (sensor S1, sampling rate 120 samples/sec), temperature sensor (sensor S2, sampling at 1 sample/sec) and pulse rate sensor (S3, sampling at 15 samples / sec). The probabilities of each event to be true: P(S1)= 0.60, P(S2)=0.25 and P(S3)=0.20. Furthermore, given the potentially different sample sizes and transmission rates for each sensor, assume that the acquisition energy costs, denoted by E(Si) are as follows: E(S1) = 0.2 nJ/sample; E(S2) = 0.05 nJ/sample and E(S3) = 0.3 nJ/sample.

Find the best acquisition sequence based on normalized acquisition cost (NAC) for the disjunctive query counterpart of Q. **[2+5]**

4. (a) Consider the Dejavu system for energy-efficient outdoor localization. Fill in the blanks using concepts from Dejavu: **[2.5]**
   i. As one enters a tunnel, the cellular signals (for the associated and neighboring cells) _____ (increases/decreases)
   ii. The curves in roads are identified by high variance in _____ (gravity acceleration / phone orientation angle / cellular RSS).
   iii. The tunnel is identified by _____ (high/low) variance in the x-axis (direction of car motion) of the ambient magnetic field and _____ (high/low) variance in the y-axis (perpendicular to the car direction of motion) of the ambient magnetic field.
   iv. Dejavu uses the _____ (DBSCAN / Euclidean / Vincenty) formula to compute the new phone position.

   (b) Give two examples of virtual landmarks? **[2]**

   (c) How do we compute the distance between two samples in the cellular or Wifi feature space ? (Do mention what the terms stand for) **[2]**

   (d) How are bridges and bumps distinct with respect to anchor classification? **[1.5]**

5. Suppose there are 2 cell-towers T_1,T_2; each having 4 cells. Cell-names are given in the following manner: C_{ij} is the name of j^{th} cell belonging to the i^{th} cell-tower. For example, C_{12} is the 2^{nd} cell of cell-tower T_1. Given is a map of the area where war-driving is done. Also note that the car has taken the reading in 1 sec interval.

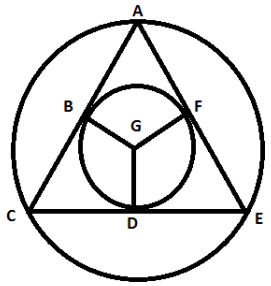


Figure 1: map

The following Table contains the X-Y co-ordinates of 7 locations A,B,C,D,E,F,G and cell strengths (in dBm) of all 8 cells at those locations Assume that the strengths of the cells

Location	**X**	**Y**	**C11**	**C12**	**C13**	**C14**	**C21**	**C22**	**C23**	**C24**
A	7	12	-50	-96	-15	-45	-78	-22	-21	-15
B	10	8	-61	-62	-56	-38	-70	-83	-57	-21
C	9	4	-81	-69	-69	-77	-10	-31	-42	-43
D	13	16	-53	-72	-42	-73	-38	-86	-67	-83
E	16	11	-20	-34	-83	-43	-59	-37	-59	-61
F	21	5	-45	-51	-73	-68	-42	-64	-75	-52
G	18	2	-42	-55	-36	-94	-75	-47	-53	-86

belonging to same cell-tower, at a particular location may differ by any amount.

(a) Find the location of cell C_{13} using strongest RSS and cell C_{24} using weighted centroid methods. **[1+2]**

(b) Use RSS Thresholding (assuming threshold -55dBm) to identify which cells can be out of the marked boundary. **[1.5]**

(c) Use Boundary Filtering to identify which cells can be out of the marked Boundary.Explain Properly **[1.5]**

(d) Use Tower-based Regrouping (using above two results) to identify whether any of the cell-towers is outside the marked boundary of the area and justify. **[1]**

End