Digital Speech Processing
Week 1: Assungment-1 Solution

1. Describe the state of the Glottis during the pronunciation of the following phoneme?
   (i) /k/, (ii) /b/, (iii) /a/, (iv) /l/, (v) /ʃ/

   A. (i) open, (ii) closed (iii) open (iv) closed (v) open
   B. (i) open, (ii) closed (iii) closed (iv) open (v) open
   C. (i) open, (ii) closed (iii) closed (iv) closed (v) open
   D. (i) open, (ii) open (iii) open (iv) closed (v) closed

2. The place and manner of articulation of the following phonemes?
   (i) /g^h/, (ii) /p/

   A. (i) velar aspirated stop or plosive, (ii) velar un-aspirated stop or plosive
   B. (i) velar aspirated voiced stop or plosive, (ii) bilabial un-aspirated unvoiced stop or plosive
   C. (i) bilabial aspirated voiced stop or plosive, (ii) velar un-aspirated stop voiced stop or plosive
   D. (i) palatal aspirated stop or plosive, (ii) velar un-aspirated unvoiced stop or plosive

3. An audio signal is recorded using the following format.
   F_S = 8 kHz, encoded with16 bit and recorded in MONO
   To store 100ms signal in PCM WAV format how much memory is required?

   A. 1600byte
   B. 16 k byte
   C. 32 k byte
   D. 80 byte

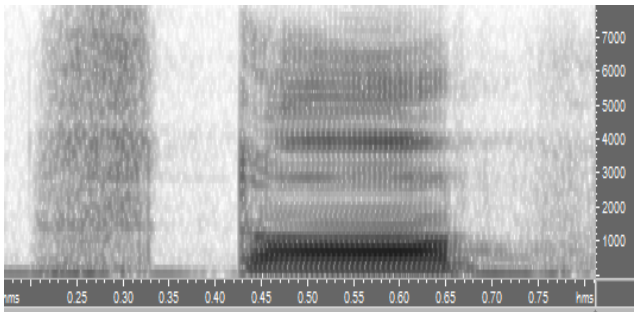
   [8k x 2 byte = 16kbyte; 16kbyte in 100 ms;

   Therefore, in 100ms signal memory required (16KB/1000)x100 =1600 byte]

4. A voiced based telephone dialing system is designed using the following words

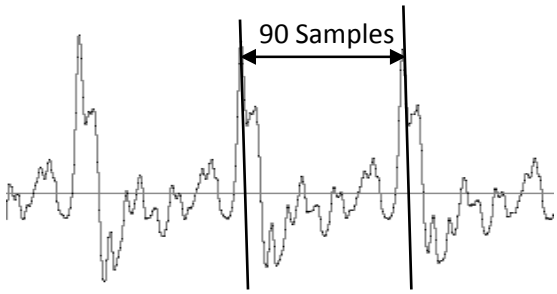
   [DIAL; STOP; ONE; TWO; THREE; FOUR; FIVE; SIX; SEVEN;EIGHT;NINE;ZERO]

   Following figure shows the spectrographic representation of the any of the above words. Using your knowledge of acoustic phonetics, determine the possible word.



A. One
B. Seven
C. Zero
D. Stop

5. Determine the F_0 of the following signal if the signal is sampled at 22050Hz



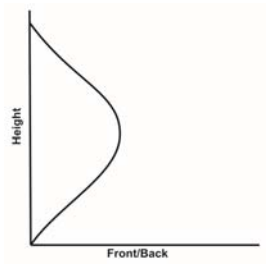
A. 220 Hz
B. 250Hz
C. 245 Hz
D. 110Hz

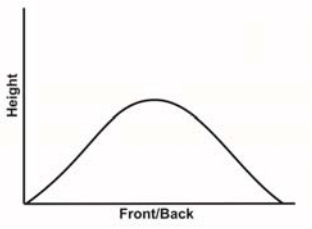
[F0 = Fs / 90 = 22050/90 = 245 Hz]

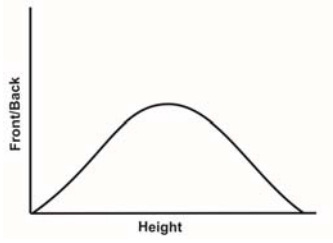
6. Table 1 shows an F_1 and F_2 of the vowels of a language plot the vowels in F_1 and F_2 plane and mark the axis intern of tongue height tongue position.

Table-1

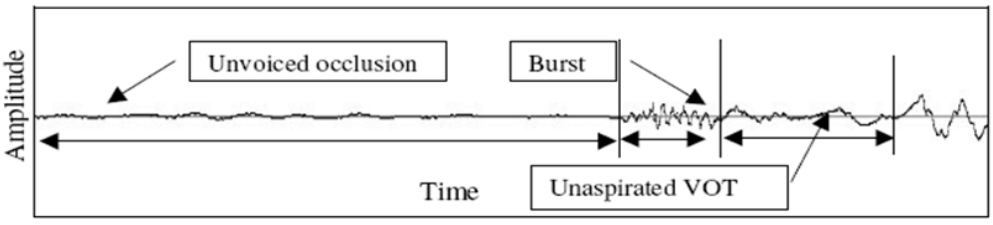
Vowels	F_1 [Hz]	F_2[Hz]
/u/	325	1035
/o/	378	1025
/ɔ/	543	1019
/a/	866	1530
/æ/	591	1846
/e/	383	1978
/i/	309	2131

A. 

B. 

C. 

7. Following figure is the time domain representation of a consonant acoustic signal. Write the possible manner of articulation of the consonant



a. Unaspirated unvoiced plosive

b. Aspirated unvoiced plosive

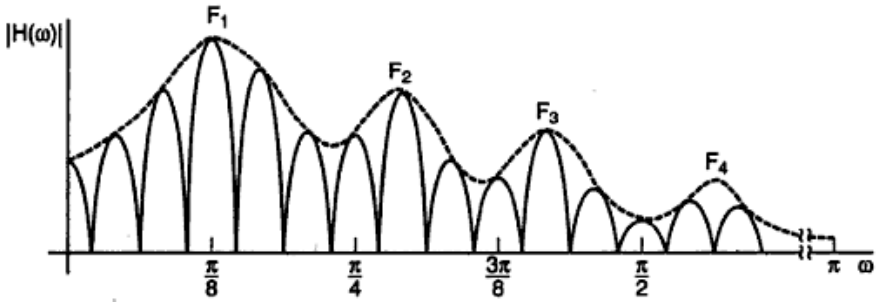
c. Voiced aspirated plosive

d. Voiced unaspirated plosive

8. An analog signal $x_a(t)=6\sin(320\pi t)+4\cos(820\pi t)$ is sampled at *600 Hz*. How many sampled will be present in one fundamenal period?

   a. 1600 Sample
   b. 150 Sample
   c. 100 Sample
   d. 1400 Sample

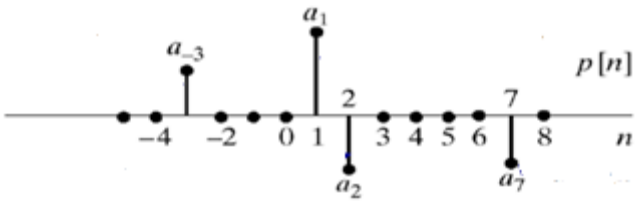
9. Figure-1 represents the magnitude of the discrete-time Fourier transform of a steady-state vowel segment. The envelope of the spectral magnitude is sketched with a dashed line. Suppose that the sampling rate is 16 kHz meet the Nyquist rate. Determine the value of the first formant frequency.



   a. 10 KHz
   b. 1 KHz
   c. 16 KHz
   d. 50 KHz

   [$2\pi = 16k$; or $\pi = 8k$; Therefore, $\pi/8 = 8k/8 = 1kHz$]

10. Following figure represents a discrete-time signal write the impulse representation of the signal.



   a. $S[n] = a_{-3}\delta[n+3] + a_2\delta[n-2] + a_1\delta[n-1] + a_7\delta[n-7]$
   b. $S[n] = a_3\delta[n-3] - a_2\delta[n+2] - a_1\delta[n+1] - a_7\delta[n+7]$
   c. $S[n] = a_{-3}\delta[n+3] + a_2\delta[n+2] - a_1\delta[n-1] - a_7\delta[n-7]$
   d. $S[n] = a_{-3}\delta[n+3] - a_2\delta[n-2] + a_1\delta[n+1] + a_7\delta[n-7]$