Quiz 1

1. (10%) Name 5 applications which use automatic speech recognition. Describe how they use ASR.

2. (10%) Name 5 applications which uses speech synthesis. Describe how they incoporate speech synthesis.

3. (10%) The waiting time T of a bus rider is 0 if he sees a bus when he arrives at a bus stop, or exponential with mean λ when he does not see a bus. The probability that he sees a bus when he arrives at a bus stop is q. Find the cdf of the waiting time T. Note that an exponential random variable X with parameter λ has a pdf of $\lambda e^{-\lambda x}$.

4. (10%) Show that any uni-variate Gaussian pdf integrates to 1.

5. (10%) The characteristic function of a random variable is defined by

$$\Phi_X(\omega) = E[e^{j\omega X}]$$

   Find the characteristic function of an exponential random variable with parameter λ.

6. (10%) The probability generating function of a nonnegative integer-valued random variable N is defined by

$$G_N(z) = E[z^N] = \sum_{n=0}^{\infty} p_N(n) z^n.$$

   Find the probability generating function of a Poisson distribution with parameter λ.

7. (10%) Find the entropy of a geometric random variable G with parameter p.

8. (10%) Show that the maximum-likelihood estimator for the mean of a uni-variate Gaussian random variable from a set of samples is the sample mean.

9. (20%) Suppose the mean μ of a Gaussian r.v. X is itself Gaussian with mean μ_0 and variance σ_0^2. The variance σ^2 is fixed. Show that the posterior distribution of μ given a sample set $\{x_1, \ldots, x_n\}$ is Gaussian.