# Ve489 Computer Networks

## Final exam: Session 1

### 10:00am-10:25am

### August 4, 2020

**Important Notes:**

1. All the exam questions are only used for yourself and for this course only. You are not allowed to distribute them to anyone else or post them anywhere. Otherwise, your behavior will lead to violation of the honor code.
2. During the exam, you should always follow JI's on-line exam rules.
3. Answer your questions in a word file. Don't forget your name and student ID. Also, each answer must be indexed consistently with the question number.
4. Submit your answer within last 5 minutes of each session, by email to the instructor. Late submission is not accepted.

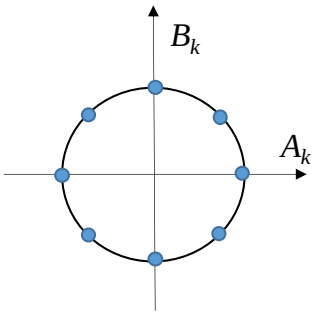
**Questions of Session 1 (Total: 25 points):**

1. Using telephone as an example, please explain what are the key features of circuit switching? (2 points)

2. Considering a PC on the internet, what kind of protocol stack model does it follow? Besides, please specify each protocol layer. (2 points)

3. If we want to increase quantization signal-to-noise ratio by 32 dB, then how many bits do we need to increase for the ADC? (2 points)

4. If the constellation map of a digital modulation scheme is shown in the following figure, then how many bits does each waveform represent in this modulation scheme? (2 points)



5. Considering bit stuffing, if a sequence of bits are stuffed, and are then sent to a node. The received bits are listed as follows:

   01111110000110101111101111111011001111110

   Please figure out what are the original bits before bit stuffing? (Note: When an error is detected, please correct it. In this question, there is one and only one bit that is erroneous in the received bits) (4 points)

6. Suppose the Hamming code parity check matrix H is shown as follows. (3 points)

$$H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

   a. How many bits are there in a codeword? (1 point)
   b. Suppose we have a single-bit error in a received codeword, and the result after conducting parity check is $\begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$, then which bit of the codeword is erroneous? (Note: the left-most bit of the codeword is considered the first bit) (2 points)

7. What are the three typical ARQ protocols? (2 points)

8. What are the key elements of an ARQ protocol? (3 points)

9. Given an $m$-bit sequence number is used in a select repeat ARQ protocol, what is relationship between send window and receive window? (3 points)

10. What is the basic mechanism of flow control? Explain it briefly. (2 points)