Final Exam (Spring, 2020)

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[1] For each description below, find all the answers from the list: [1 pt each, No partial pt]

① Find all the data communication channels in your smartphone [K), P), R), U)]
② What are the three angular motions of a gyro sensor? [N), Q), Y)]
③ Find all the proprioceptive sensors in your smartphone [~~A) Accelerometer~~ A), F), E)]
④ Find all the actuators in your smartphone [B)]
⑤ Find all the proximity sensors from the list [T)]
⑥ What are the two components consisting of active sensors? [P), U)]
⑦ [M] sensor produces an electric voltage when there is a pressure difference between the two sides.
⑧ [E] measures a change in velocity of a linear motion in 3D space.

A) Accelerometer	F) Gyroscope	K) Microphone	P) Receiver	U) Transmitter
B) AMOLED	G) Infrared sensor	L) NFC	Q) Roll	V) Ultrasonic
C) Bluetooth	H) LCD	M) Piezoelectric	R) Speaker	W) USB
D) CMOS sensor	I) LIDAR	N) Pitch	S) Thermal	X) WLAN
E) GPS	J) Mechanical switch	O) RADAR	T) Touch screen	Y) Yaw

[2] For each description below, choose either **True** or **False**: [1 pt each, -1 pt for wrong answer]

① The decimal number 219 corresponds to 11011101 in 8-bit binary number [False]
② **Huffman coding** is a lossless compression, but **Run-length coding** is a lossy compression. [False]
③ In **analog-to-digital conversion**, the only technique to avoid **aliasing** is to satisfy the **Nyquist sampling rate**. [True]
④ The only method to reduce the errors in data transmission is to increase the **signal duration** because the increase in signal duration increases the **signal energy** while decreasing the **noise variance**. [False]
⑤ A pair of **complementary** signals never become **orthogonal**. [True]
⑥ The two binary signals {1, 1, 1, -1, -1, -1} and {1, -1, 1, -1, 1, -1} are **orthogonal**. ~~[True]~~ [False]
⑦ **Channel capacity** of wireless transmission is proportional to both the **bandwidth** and the **transmission range**. [False]

[3] Fill in the blank. [2 pts each, No partial pt]

① [Channel capacity] describes both the quality of the received signal and the probability of detecting the correct data value.
② [ ] theorem says that the sum of n independent random variables approaches to a Gaussian distribution as n becomes large, no matter what the distributions of the random variables have.
③ [ ], [ ], and [ ] are the three components of a linear filter.
④ The matched processor computes [Correlation] between the target signal and the received signal.
⑤ [harmonic] frequencies are integer-multiple of the fundamental frequency.
⑥ [Data file Entropy] represents the average number of bits that are required to represent the symbols from a source as a binary code.
⑦ When comparing two binary strings of equal length, [Hamming] distance is the number of bit positions where the two bits are different.