

ECEN4503 Exam #1 18 February 2011

1) A red and white six sided fair die are thrown.
 [25] **Compute the probability** that the number of dots showing on the red die differs from the number of dots showing on the white die by \pm one dot. [Answer = 0.2778]

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2) A random voltage X has PDF $f_X(x) = \alpha\delta(x+1) + x + 1; -1 \leq x \leq 0$.

2a) [10] **Compute** the value of α . [1/2]

2b) [15] If a random voltage $Y = 3X^2$, **find an equation** for $f_Y(y)$.

[$f_Y(y) = (1-(y/3)^{0.5})/(6(y/3)^{0.5}) + 0.5\delta(y-3); 0 \leq y \leq 3$.]

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3) Define a random variable X to be the time an IC fails, in years. The PDF of X is known to be exponentially distributed with a mean of 4 years and is of form

$$f_X(x) = 0.25e^{-0.25x}; x \geq 0.$$

3a [10] **Compute** P(an IC fails before 1 full year of operation). [0.2212]

3b [15] Suppose a printed circuit board in a telephone switch has 10 of these IC's. If any IC fails, the entire board fails and becomes inoperable. IC failures on this board are known to be statistically independent. **Compute** P(the board fails before 1 full year of operation). [0.9179]

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4) A random voltage X is known to be Gaussian Distributed with a mean $E[X] = 0$ and standard deviation σ of 2 volts. This voltage is input to circuit shown to the right, yielding an output voltage Y. **Sketch** the output PDF $f_Y(y)$.

[You should sketch a delta function centered at 0 volts, with area = 1.]

