

# Complex Exam Post midterms I

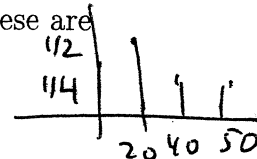
## PRACTICE EXAM EE 416

1. (15 points)

A cellular provider measures the duration (seconds) of 4 calls. These are

$$v \in [40, 20, 50, 20]$$

Given that this is the universe of all calls,



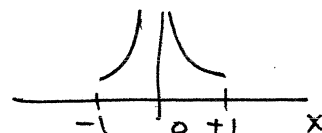
(a) provide a labeled sketch the PMF for the duration of a random call  $v$ .

(b) Determine the mean duration of a call.  $20 \times \frac{1}{2} + 40 \times \frac{1}{4} + 50 \times \frac{1}{4} = 32.5$

2. (15 points)

A RV  $x$  has pdf

$$p(x) = C|x|^{-\frac{1}{2}}, \quad -1 \leq x \leq +1$$



(a) Sketch the pdf.

(b) Determine  $C$ .

$$(C = 1/4)$$

(c) Find  $P\{x > 0\}$ .

$$(1/2) \text{ by symmetry}$$

3. (30 points)

A positive RV  $x$  is known to satisfy

$$P\{x > x\} = \exp(-x^c) \quad (\text{Weibull!})$$

(a) Find the CDF for  $x$ .

$$1 - e^{-x^c}$$

(b) Find the PDF for  $x$ .

$$c x^{c-1} e^{-x^c}$$

(c) Find all the values of  $c$  for which this is a proper PDF.

$$c > 0$$

4. (20 points)

A communications channel scales the the input amplitude  $A > 0$  by a random amount  $\sqrt{v}$  and puts out

$$r = A\sqrt{v}$$

Assuming that the power  $v$  is exponentially distributed with mean 1,

(a) Find the CDF of the RV  $r$

$$P(r) = 1 - e^{-r^2/A^2}$$

(b) What is the probability that the output is smaller than the input?  $P\{v < 1\} = 1 - \frac{1}{e}$

5. (20 points)

With good service, a random customer drops a cellular provider with probability  $p = .4$ . However, given 'bad service' the drop probability increases to  $p = .8$ , where 'bad service' incidents occur only 10% of the time. There are only two types of service: Good and Bad.

(a) Determine the Probability that a customer drops, regardless of service.

(b) Given a drop, what is the probability of bad service?

$$P_{\text{Drop}} = P_{\text{drop|bad}} \frac{1}{10} + P_{\text{drop|good}} \frac{9}{10}$$

$$= (.8)(.1) + (.4)(.9)$$

$$= .44$$

$$P_{\text{bad|drop}} = \frac{P_{\text{drop|bad}} P_{\text{bad}}}{P_{\text{drop}}}$$

$$= \frac{(.8)(.1)}{.44}$$