Homework 4

Jacqueline Antwi-Danso

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1 PROBLEM 2A, PART 1

Show that the probability distribution p(x) from which the sample points should be drawn is given by

$$p(x) = \frac{1}{2\sqrt{x}}$$

Solution:

$$\begin{aligned} w(x) &= x^{-\frac{1}{2}} \\ p(x) &= \frac{w(x)}{\int_0^1 w(x')dx'} \\ \int_0^1 w(x')dx' &= \int_0^1 x'^{-\frac{1}{2}}dx' \\ &= 2(1^{-\frac{1}{2}} - 0) \\ p(x) &= \frac{x^{-\frac{1}{2}}}{2} \\ p(x) &= \frac{1}{2\sqrt{x}} \end{aligned}$$

2 PROBLEM 2A, PART 2

...and derive a transformation formula for generating random numbers between zero and one from this distribution.
Solution:

$$\begin{aligned}
\int_0^{x(z)} w(x')\,dx' &= \int_0^x x'^{-\frac{1}{2}}\,dx' \\
&= \int_0^x x'^{-\frac{1}{2}}\,dx' \\
&= x^{-\frac{1}{2}} - 0 \\
&= z \\
x(z) &= z^2
\end{aligned}$$