Assignment 7

September 15, 2018

In [2]:
```
using Distributions;
using Gadfly, Cairo;

white_panel = Theme(panel_fill = colorant"white",
                    default_color= colorant"blue",
                    major_label_font_size=14pt,
                    minor_label_font_size=10pt,
                    major_label_color=colorant"black",
                    minor_label_color=colorant"black");

# Q1.a Find the probability that the doum time is not more than 2 hours.
ans_1a = cdf(Gamma(4,1.5), 2)
```

Out[2]:
```
0.04649430286533402
```

In [4]:
```
# Q2.a If $700 is budgeted to cover repairs for next week, what is the probability that
# will exceed the budgeted amount?

p_x_moreThan700 = cdf(Normal(600,40),700);
p_x_lessThan700 = 1 - p_x_moreThan700
```

Out[4]:
```
0.006209665325776159
```

In [34]:
```
# How much should be budgeted weekly for maintenance and repairs to ensure that the pro
 # that the budgeted amount will be exceeded in any given week is only 0.1?
 # which mean at what point on the normal distribution will it exceed 90%

 ans_2b = 1 - cdf(Normal(600,40),651)
 # When the budget exceeds $651 it will exceed 90%
```

Out[34]:
```
0.10115462099558581
```

In [6]:
```
# Q3.a Suppose that a batch with more than 30% impurities cannot be sold. What is the pr
# a randomly selected batch cannot be sold for this reason? (This is a Beta distribution
# the parameters and write Julia code)

# alpha=4  beta=2
p_x_lessThan30 = cdf(Beta(4,2), 0.3);
p_x_moreThan30 = 1 - p_x_lessThan30
```

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Exercise for lecture 6:

(1)

b). $\alpha = 4$, $\beta = 1.5$, $l = 30x + 2$

$E(x) = \alpha\beta = 6$ $\quad\quad$ $\alpha\beta^2 = \sigma^2(x)$

$\boxed{\sigma^2(x) = 9}$ $\quad$ $\boxed{E(x) = 6}$

$\sigma^2(x) = E(x^2) - [E(x)]^2$

$9 = E(x^2) - 36$

$\boxed{E(x^2) = 45}$

$E(l) = E(30x + 2) = 30E(x) + 2$

$= 30(6) + 2$

$\boxed{E(30l + 2) = 182}$

$\sigma^2(l) = E(l^2) - [E(l)]^2$

$= E(900x^2 + 4 + 120x) - (182)^2$

$= 900E(x^2) + 4 + 120E(x) - (182)^2$

$= 900(45) + 4 + 120(6) - (182)^2$

$= 40500 + 424 - 33124$

$\boxed{\sigma^2(l) = 8100}$

```
Out[6]: 0.96922

In [35]: # Q3 b. Suppose that the dollar value of each batch is given by v = 10  0.75x. Find the
         # and variance of v

         Expected = mean(Beta(4,2))
         Variance = var(Beta(4.2))

         E_x = 10 -0.75*Expected

Out[35]: 9.5

In [11]: # 4 What is the probability that a randomly selected bearing of this type will fail in
         # hours? (Write Julia code)

         ans_4a = cdf(Weibull(4,2),2)

Out[11]: 0.6321205588285577

In [9]: # pdf of the distributions
        # 5.1 Gamma

        x1 = collect(0:1:24*7);
        y1 = pdf.(Gamma(4,1.5),x1)

        myplot = plot(layer(x=x1, y=y1, Geom.line, Theme(default_color=colorant"orange")),
        Coord.Cartesian(xmin=0, xmax=24*7), Guide.ylabel("p(x)"));
        draw(PNG(5inch, 5inch), myplot)
```

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(3)

b). $\alpha = 4$, $\beta = 2$

$E(V) = E(10 - 0.75x)$

$= 10 - 0.75\, E(x)$

$E(x) = \frac{\alpha}{\alpha+\beta} = \frac{4}{6} = 0.66$

$\sigma^2(x) = \frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)} = \frac{8}{(6)^2(7)} = 0.03$

$E(V) = 10 - 0.75\,(0.66)$

$= 10 - 0.493$

$\boxed{E(V) = 9.5}$

$\sigma^2(V) = E(V^2) - [E(V)]^2$

$= E(100 + (0.75x)^2 - 15x) - (9.5)^2$

$= 100 - 15(0.66) + 0.56(E(x^2)) - 90.25$

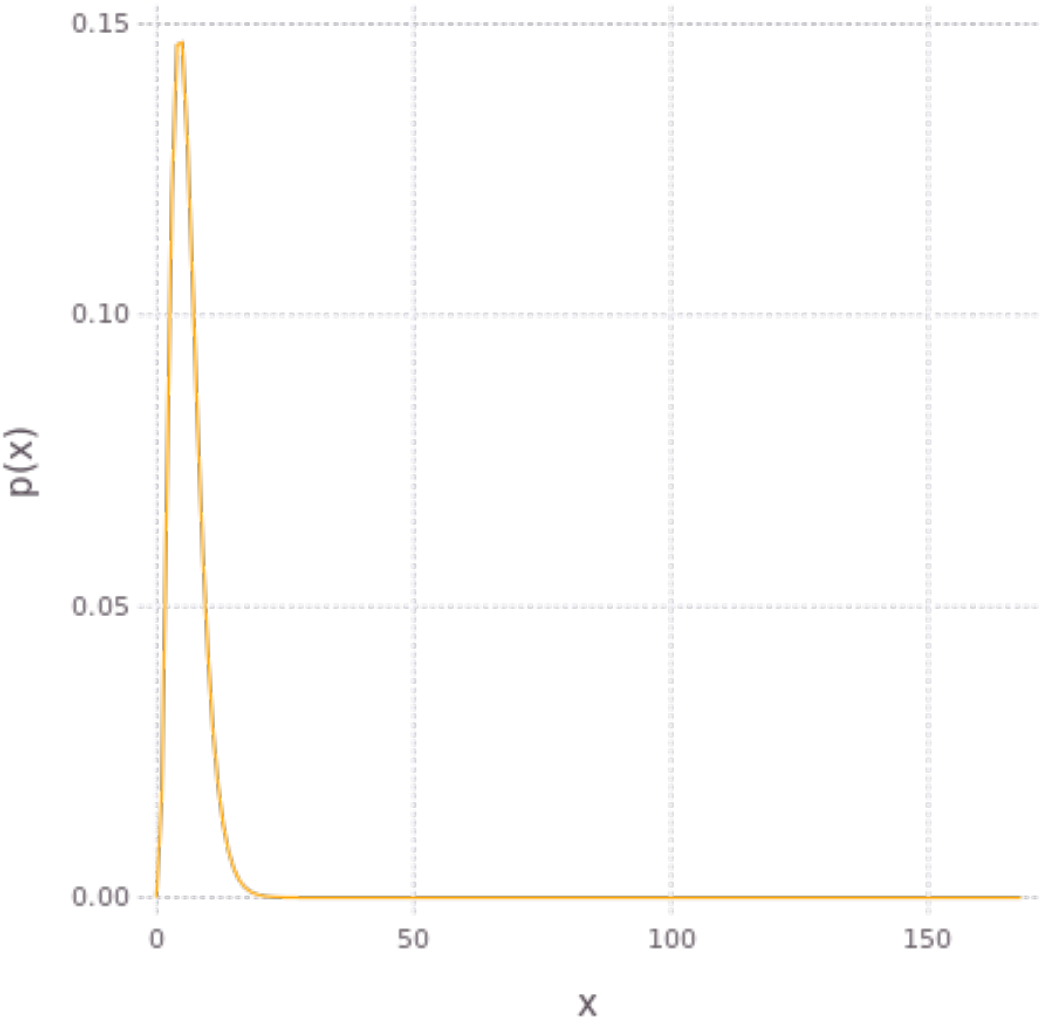
$\boxed{\sigma^2(V) = 0.107}$

(4) b). $\gamma = \theta^{1/\gamma}\left(\gamma\left(1 + \frac{1}{\gamma}\right)\right)$

$= 4^{1/2}\left(\gamma\left(1 + \frac{1}{2}\right)\right)$

$= 4^{1/2}(\gamma(1.5))$

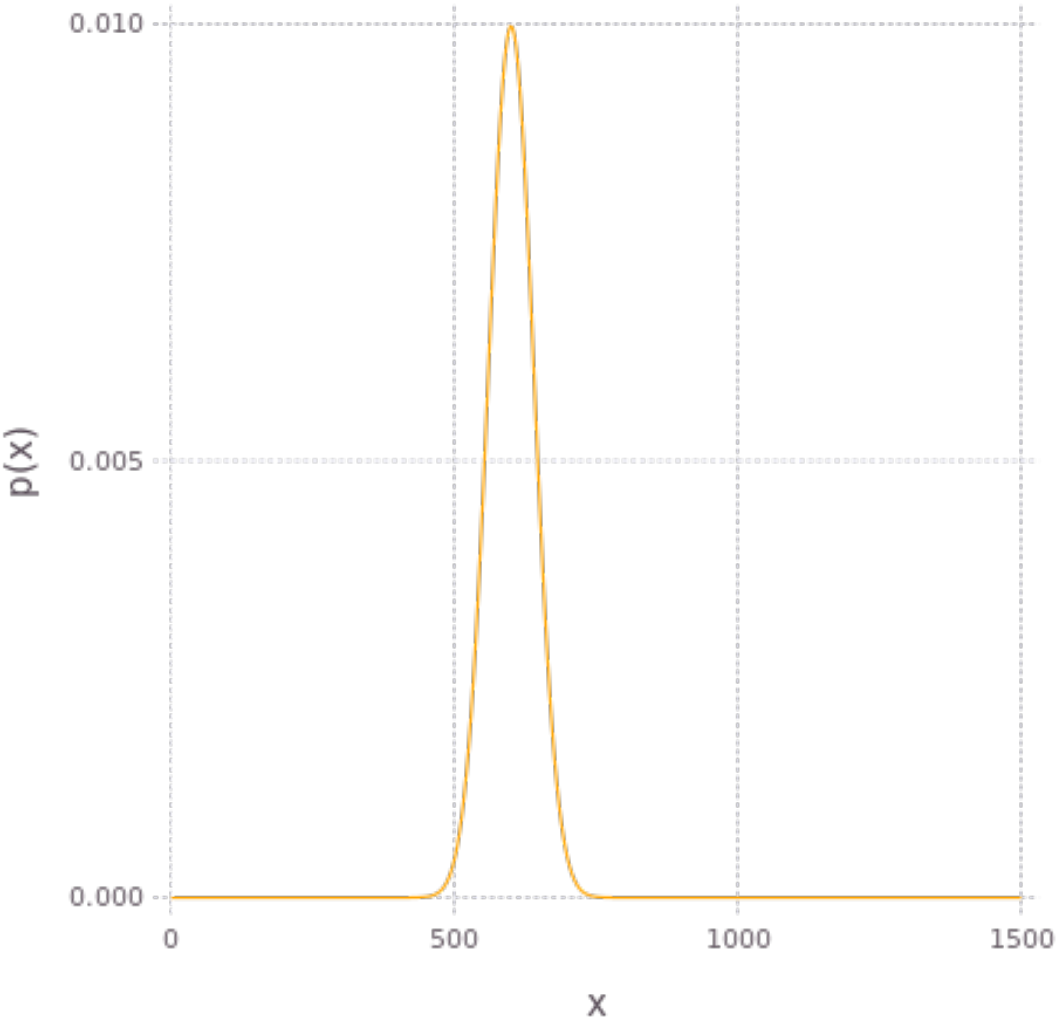
$= 2(\gamma(1.5))$



Out[9]: false

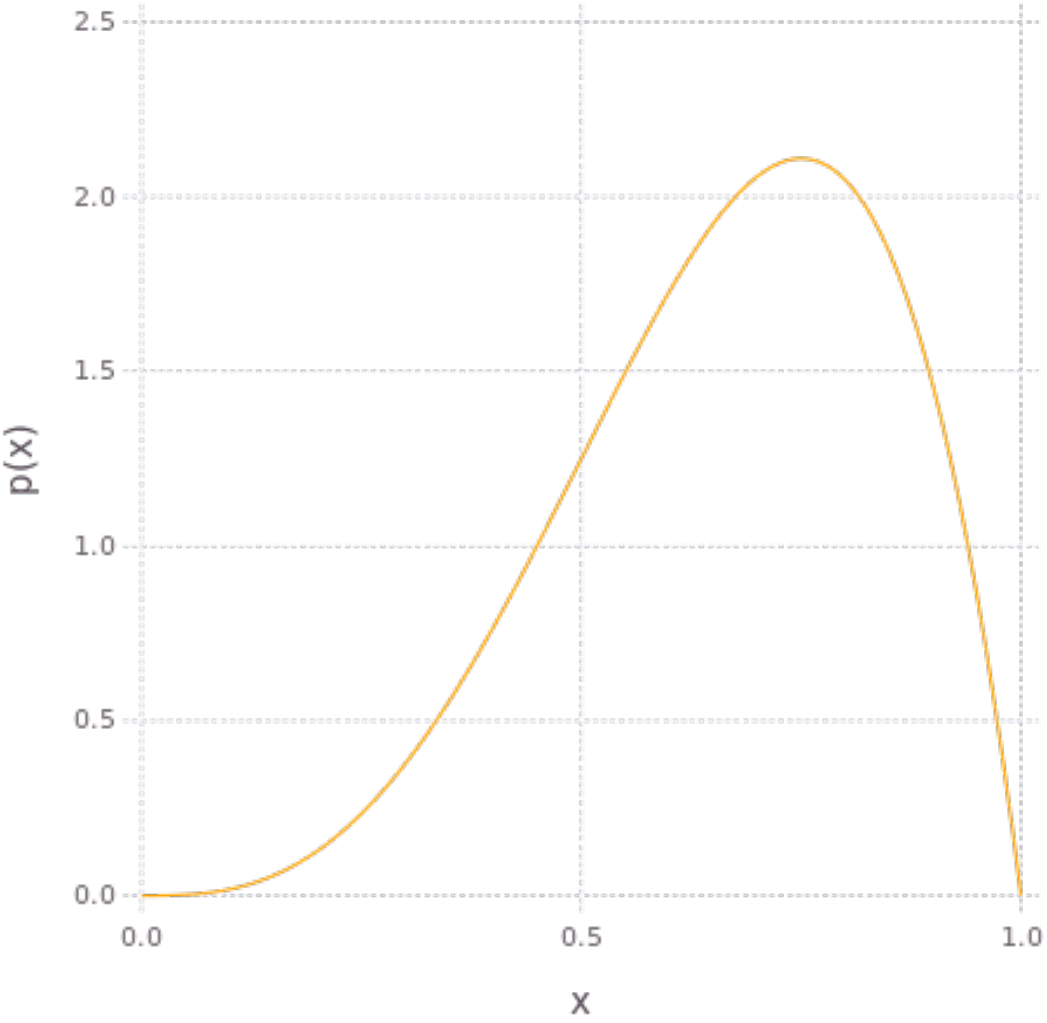
In [10]: *# 5.2 Normal*

```
x2 = collect(0:1:1500)
y2 = pdf.(Normal(600,40),x2)
myplot = plot(layer(x=x2, y=y2, Geom.line, Theme(default_color=colorant"orange")),
Coord.Cartesian(xmin=0, xmax=1500), Guide.ylabel("p(x)"));
draw(PNG(5inch, 5inch), myplot)
```



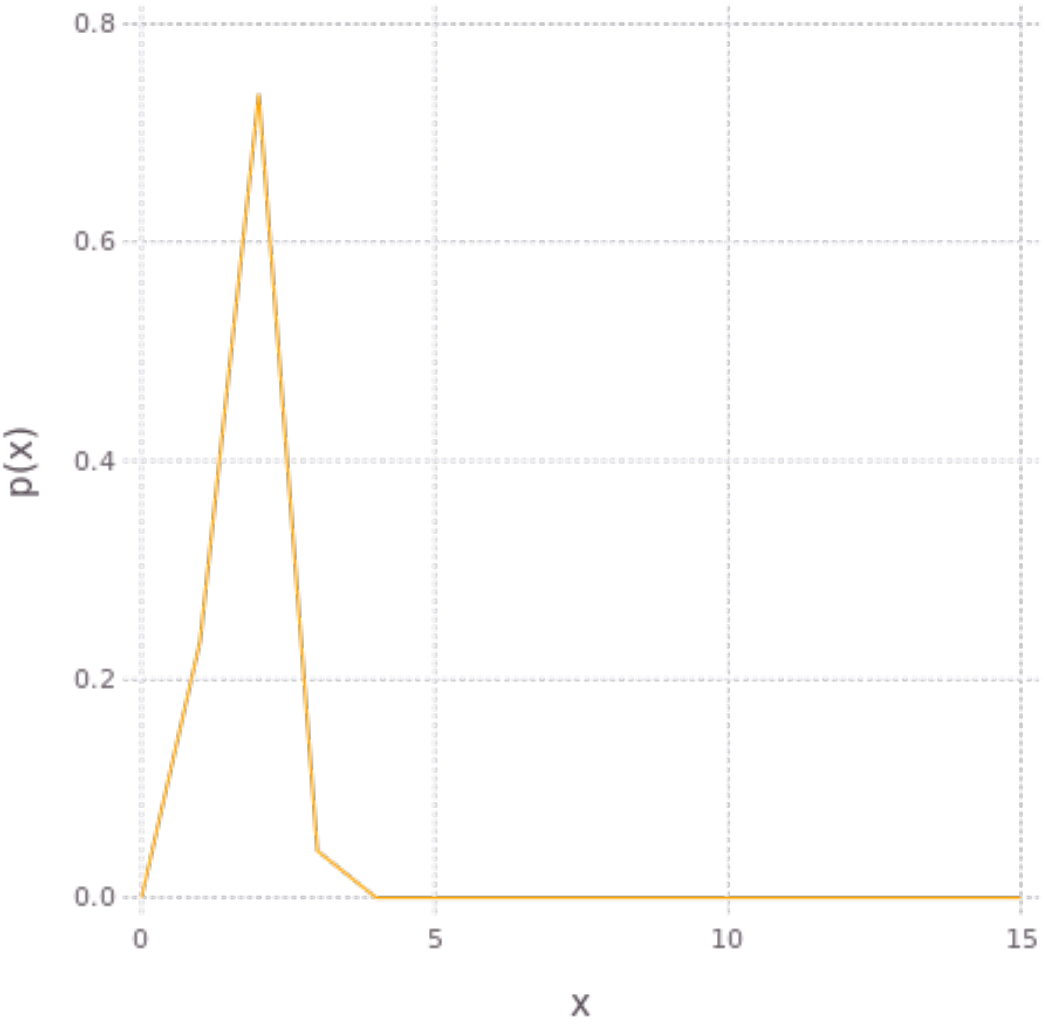
Out[10]: false

In [12]:
```
# 5.3 Beta

x3 = collect(0:0.01:1)
y3 = pdf.(Beta(4,2),x3)
myplot = plot(layer(x=x3, y=y3, Geom.line, Theme(default_color=colorant"orange")),
Coord.Cartesian(xmin=0, xmax=1), Guide.ylabel("p(x)"));
draw(PNG(5inch, 5inch), myplot)
```



Out[12]: false

In [13]:
```
#  5.4 Weibull
x4 = collect(0:1:15)
y4 = pdf.(Weibull(4,2),x4)

myplot = plot(layer(x=x4, y=y4, Geom.line, Theme(default_color=colorant"orange")),
Coord.Cartesian(xmin=0, xmax=15), Guide.ylabel("p(x)"));
draw(PNG(5inch, 5inch), myplot)
```



Out[13]: false

In [ ]: