Problem1

October 22, 2016

```
In [15]: function productACapacity(maxMachine)
             tEnd = 10
             hourWeek = round(Int64,((21 * 7) - 20) * 0.85)
             InvStations = zeros(8, hourWeek*(tEnd+1))
             processInv = zeros(30, hourWeek*(tEnd+1))
             finishedInv = zeros(1, hourWeek*(tEnd+1))
             speed = [25.3, 23.2, 100.5, 15.5, 32.9, 60.0, 50.2, 33.5]
             #maxMachine = [1 1 1 1 1 1 1 1]
             t = 0
             hour = 0

             while t< tEnd
                 t+=1
                 endHour = (t)*hourWeek
                 hour = (t-1)*hourWeek

                 finishedInv[hour+1:end] = 0
                 while hour < endHour
                     #@show hour
                     hour += 1
                     InvStations[1, hour:end] += speed[1]*2
                     notBusy1 = true
                     notBusy2 = true
                     notBusy3 = true
                     notBusy4 = true
                     notBusy5 = true
                     notBusy6 = true
                     notBusy7 = true
                     notBusy8 = true
                     nMacUse = [0 0 0 0 0 0 0 0]
                     #  At station 1
                     while notBusy1
                         if rand() <= 0.85
                             if (processInv[15,hour] > 0) && notBusy1
                                 nProcess = min(speed[1], processInv[15,hour])
                                 InvStations[5,hour:end] += nProcess #* 0.8
                                 InvStations[6,hour:end] -= nProcess

                                 processInv[16,hour:end] += nProcess #* 0.8
                                 processInv[15, hour:end] -= nProcess

                                 nMacUse[1] += 1
                                 if nMacUse[1] == maxMachine[1]
```

```
                notBusy1 = false
            end
        end
        if (processInv[7,hour] > 0) && notBusy1
            nProcess = min(speed[1], processInv[7,hour])
            InvStations[5,hour:end] += nProcess #* 0.8
            InvStations[3,hour:end] -= nProcess

            processInv[8,hour:end] += nProcess #* 0.8
            processInv[7, hour:end] -= nProcess

            nMacUse[1] += 1
            if nMacUse[1] == maxMachine[1]
                notBusy1 = false
            end
        end
        if (processInv[5,hour] > 0) && notBusy1
            nProcess = min(speed[1], processInv[5,hour])
            InvStations[3,hour:end] += nProcess  #* 0.8
            InvStations[6,hour:end] -= nProcess

            processInv[6,hour:end] += nProcess #* 0.8
            processInv[5, hour:end] -= nProcess

            nMacUse[1] += 1
            if nMacUse[1] == maxMachine[1]
                notBusy1 = false
            end
        end
        if (processInv[2,hour] > 0) && notBusy1
            nProcess = min(speed[1], processInv[2,hour])
            InvStations[2,hour:end] += nProcess #* 0.8
            InvStations[1,hour:end] -= nProcess

            processInv[3,hour:end] += nProcess #* 0.8
            processInv[2, hour:end] -= nProcess

            nMacUse[1] += 1
            if nMacUse[1] == maxMachine[1]
                notBusy1 = false
            end
        end
        if notBusy1
            nProcess = speed[1] #* 0.8
            InvStations[2,hour:end] += nProcess

            processInv[1,hour:end] += nProcess

            nMacUse[1] += 1
            if nMacUse[1] == maxMachine[1]
                notBusy1 = false
            end
        end
    else
```

```
            nMacUse[1] += 1
                if nMacUse[1] == maxMachine[1]
                    notBusy1 = false
                end
        end
    end
    # At station 2
    while notBusy2
        if rand() <= 0.6
            if (processInv[29,hour] > 0) && notBusy2
                nProcess = min(speed[2], processInv[29,hour])
                InvStations[3,hour:end] += nProcess #* 0.7
                InvStations[8,hour:end] -= nProcess

                processInv[30,hour:end] += nProcess #* 0.7
                processInv[29, hour:end] -= nProcess

                nMacUse[2] += 1
                if nMacUse[2] == maxMachine[2]
                    notBusy2 = false
                end
            end
            if (processInv[26,hour] > 0) && notBusy2
                nProcess = min(speed[2], processInv[26,hour])
                InvStations[4,hour:end] += nProcess #* 0.7
                InvStations[7,hour:end] -= nProcess

                processInv[27,hour:end] += nProcess #* 0.7
                processInv[26, hour:end] -= nProcess

                nMacUse[2] += 1
                if nMacUse[2] == maxMachine[2]
                    notBusy2 = false
                end
            end
            if (processInv[23,hour] > 0) && notBusy2
                nProcess = min(speed[2], processInv[23,hour])
                InvStations[4,hour:end] += nProcess #* 0.7
                InvStations[5,hour:end] -= nProcess

                processInv[24,hour:end] += nProcess #* 0.7
                processInv[23, hour:end] -= nProcess

                nMacUse[2] += 1
                if nMacUse[2] == maxMachine[2]
                    notBusy2 = false
                end
            end
            if (processInv[20,hour] > 0) && notBusy2
                nProcess = min(speed[2], processInv[20,hour])
                InvStations[4,hour:end] += nProcess #* 0.7
                InvStations[7,hour:end] -= nProcess

                processInv[21,hour:end] += nProcess #* 0.7
```

```
    processInv[20, hour:end] -= nProcess

    nMacUse[2] += 1
    if nMacUse[2] == maxMachine[2]
        notBusy2 = false
    end
end
if (processInv[17,hour] > 0) && notBusy2
        nProcess = min(speed[2], processInv[17,hour])
        InvStations[4,hour:end] += nProcess #* 0.7
        InvStations[5,hour:end] -= nProcess

        processInv[18,hour:end] += nProcess #* 0.7
        processInv[17, hour:end] -= nProcess

        nMacUse[2] += 1
        if nMacUse[2] == maxMachine[2]
            notBusy2 = false
        end
end
if (processInv[13,hour] > 0) && notBusy2
    nProcess = min(speed[2], processInv[13,hour])
    InvStations[6,hour:end] += nProcess #* 0.7
    InvStations[6,hour:end] -= nProcess

    processInv[14,hour:end] += nProcess #* 0.7
    processInv[13, hour:end] -= nProcess

    nMacUse[2] += 1
    if nMacUse[2] == maxMachine[2]
        notBusy2 = false
    end
end
if (processInv[11,hour] > 0) && notBusy2
    nProcess = min(speed[2], processInv[11,hour])
    InvStations[6,hour:end] += nProcess #* 0.7
    InvStations[4,hour:end] -= nProcess

    processInv[12,hour:end] += nProcess #* 0.7
    processInv[11, hour:end] -= nProcess

    nMacUse[2] += 1
    if nMacUse[2] == maxMachine[2]
        notBusy2 = false
    end
end
if (processInv[9,hour] > 0) && notBusy2
        nProcess = min(speed[2], processInv[9,hour])
        InvStations[4,hour:end] += nProcess #* 0.7
        InvStations[5,hour:end] -= nProcess

        processInv[10,hour:end] += nProcess #* 0.7
        processInv[9, hour:end] -= nProcess
```

```
                nMacUse[2] += 1
                if nMacUse[2] == maxMachine[2]
                    notBusy2 = false
                end
            end
            if (processInv[3,hour] > 0) && notBusy2
                nProcess = min(speed[2], processInv[3,hour])
                InvStations[6,hour:end] += nProcess #* 0.7
                InvStations[1,hour:end] -= nProcess

                processInv[4,hour:end] += nProcess #* 0.7
                processInv[3, hour:end] -= nProcess

                nMacUse[2] += 1
                if nMacUse[2] == maxMachine[2]
                    notBusy2 = false
                end
            end
            if (processInv[1,hour] > 0) && notBusy2
                nProcess = min(speed[2], processInv[1,hour])
                InvStations[1,hour:end] += nProcess #* 0.7
                InvStations[1,hour:end] -= nProcess

                processInv[2,hour:end] += nProcess #* 0.7
                processInv[1, hour:end] -= nProcess

                nMacUse[2] += 1
                if nMacUse[2] == maxMachine[2]
                    notBusy2 = false
                end
            end
        else
            nMacUse[2] += 1
                if nMacUse[2] == maxMachine[2]
                    notBusy2 = false
                end
        end
    end

    # At station 3
    while notBusy3
        if rand() <= 0.80
            if (processInv[30,hour] > 0) && notBusy3
                nProcess = min(speed[3], processInv[30,hour])
                finishedInv[hour:end] += nProcess #* 0.8
                InvStations[2,hour:end] -= nProcess

                processInv[30, hour:end] -= nProcess

                nMacUse[3] += 1
                if nMacUse[3] == maxMachine[3]
                    notBusy3 = false
                end
            end
```

```
        if (processInv[6,hour] > 0) && notBusy3
            nProcess = min(speed[3], processInv[6,hour])
            InvStations[1,hour:end] += nProcess #* 0.8
            InvStations[1,hour:end] -= nProcess

            processInv[7,hour:end] += nProcess #* 0.8
            processInv[6, hour:end] -= nProcess

            nMacUse[3] += 1
            if nMacUse[3] == maxMachine[3]
                notBusy3 = false
            end
        end
    else
        nMacUse[3] += 1
        if nMacUse[3] == maxMachine[3]
            notBusy3 = false
        end
    end
end

# At station 4
while notBusy4
    if rand() <= 0.60
        if (processInv[27,hour] > 0) && notBusy4
            nProcess = min(speed[4], processInv[27,hour])
            InvStations[8,hour:end] += nProcess# * 0.8
            InvStations[2,hour:end] -= nProcess

            processInv[28,hour:end] += nProcess #* 0.8
            processInv[27, hour:end] -= nProcess

            nMacUse[4] += 1
            if nMacUse[4] == maxMachine[4]
                notBusy4 = false
            end
        end
        if (processInv[24,hour] > 0) && notBusy4
            nProcess = min(speed[4], processInv[24,hour])
            InvStations[5,hour:end] += nProcess# * 0.8
            InvStations[2,hour:end] -= nProcess

            processInv[25,hour:end] += nProcess# * 0.8
            processInv[24, hour:end] -= nProcess

            nMacUse[4] += 1
            if nMacUse[4] == maxMachine[4]
                notBusy4 = false
            end
        end
        if (processInv[21,hour] > 0) && notBusy4
            nProcess = min(speed[4], processInv[21,hour])
            InvStations[7,hour:end] += nProcess# * 0.8
            InvStations[2,hour:end] -= nProcess
```

```
                processInv[22,hour:end] += nProcess# * 0.8
                processInv[21, hour:end] -= nProcess

                nMacUse[4] += 1
                if nMacUse[4] == maxMachine[4]
                    notBusy4 = false
                end
            end
            if (processInv[18,hour] > 0) && notBusy4
                nProcess = min(speed[4], processInv[18,hour])
                InvStations[7,hour:end] += nProcess# * 0.8
                InvStations[2,hour:end] -= nProcess

                processInv[19,hour:end] += nProcess #* 0.8
                processInv[18, hour:end] -= nProcess

                nMacUse[4] += 1
                if nMacUse[4] == maxMachine[4]
                    notBusy4 = false
                end
            end
            if (processInv[10,hour] > 0) && notBusy4
                nProcess = min(speed[4], processInv[10,hour])
                InvStations[2,hour:end] += nProcess# * 0.8
                InvStations[2,hour:end] -= nProcess

                processInv[11,hour:end] += nProcess# * 0.8
                processInv[10, hour:end] -= nProcess

                nMacUse[4] += 1
                if nMacUse[4] == maxMachine[4]
                    notBusy4 = false
                end
            end
        else
            nMacUse[4] += 1
            if nMacUse[4] == maxMachine[4]
                notBusy4 = false
            end
        end
    end
    # At station 5
    while notBusy5
        if rand() <= 0.85
            if (processInv[22,hour] > 0) && notBusy5
                nProcess = min(speed[5], processInv[22,hour])
                InvStations[2,hour:end] += nProcess #* 0.8
                InvStations[4,hour:end] -= nProcess

                processInv[23,hour:end] += nProcess #* 0.8
                processInv[22, hour:end] -= nProcess

                nMacUse[5] += 1
```

```
            if nMacUse[5] == maxMachine[5]
                notBusy5 = false
            end
        end
        if (processInv[16,hour] > 0) && notBusy5
            nProcess = min(speed[5], processInv[16,hour])
            InvStations[2,hour:end] += nProcess# * 0.8
            InvStations[1,hour:end] -= nProcess

            processInv[17,hour:end] += nProcess# * 0.8
            processInv[16, hour:end] -= nProcess

            nMacUse[5] += 1
            if nMacUse[5] == maxMachine[5]
                notBusy5 = false
            end
        end
        if (processInv[8,hour] > 0) && notBusy5
            nProcess = min(speed[5], processInv[8,hour])
            InvStations[2,hour:end] += nProcess #* 0.8
            InvStations[1,hour:end] -= nProcess

            processInv[9,hour:end] += nProcess #* 0.8
            processInv[8, hour:end] -= nProcess

            nMacUse[5] += 1
            if nMacUse[5] == maxMachine[5]
                notBusy5 = false
            end
        end
    else
        nMacUse[5] += 1
            if nMacUse[5] == maxMachine[5]
                notBusy5 = false
            end
    end
end
# At station 6
while notBusy6
    if rand() <= 0.60
        if (processInv[14,hour] > 0) && notBusy6
            nProcess = min(speed[6], processInv[14,hour])
            InvStations[1,hour:end] += nProcess #* 0.8
            InvStations[2,hour:end] -= nProcess

            processInv[15,hour:end] += nProcess #* 0.8
            processInv[14, hour:end] -= nProcess

            nMacUse[6] += 1
            if nMacUse[6] == maxMachine[6]
                notBusy6 = false
            end
        end
        if (processInv[12,hour] > 0) && notBusy6
```

```
                nProcess = min(speed[6], processInv[12,hour])
                InvStations[2,hour:end] += nProcess# * 0.8
                InvStations[2,hour:end] -= nProcess

                processInv[13,hour:end] += nProcess# * 0.8
                processInv[12, hour:end] -= nProcess

                nMacUse[6] += 1
                if nMacUse[6] == maxMachine[6]
                    notBusy6 = false
                end
            end
            if (processInv[4,hour] > 0) && notBusy6
                nProcess = min(speed[6], processInv[4,hour])
                InvStations[1,hour:end] += nProcess# * 0.8
                InvStations[2,hour:end] -= nProcess

                processInv[5,hour:end] += nProcess# * 0.8
                processInv[4,hour:end] -= nProcess

                nMacUse[6] += 1
                if nMacUse[6] == maxMachine[6]
                    notBusy6 = false
                end
            end
        else
            nMacUse[6] += 1
            if nMacUse[6] == maxMachine[6]
                notBusy6 = false
            end
        end
    end
        # At station 7
    while notBusy7
        if rand() <= 0.70
            if (processInv[25,hour] > 0) && notBusy7
                nProcess = min(speed[7], processInv[25,hour:end])
                InvStations[2,hour:end] += nProcess #* 0.8
                InvStations[4,hour:end] -= nProcess

                processInv[26,hour:end] += nProcess #* 0.8
                processInv[25, hour:end] -= nProcess

                nMacUse[7] += 1
                if nMacUse[7] == maxMachine[7]
                    notBusy7 = false
                end
            end
            if (processInv[19,hour] > 0) && notBusy7
                nProcess = min(speed[7], processInv[19,hour])
                InvStations[2,hour:end] += nProcess #* 0.8
                InvStations[4,hour:end] -= nProcess

                processInv[20,hour:end] += nProcess #* 0.8
```

```
                                processInv[19, hour:end] -= nProcess

                                nMacUse[7] += 1
                                if nMacUse[7] == maxMachine[7]
                                    notBusy7 = false
                                end
                            end

                        else
                            nMacUse[7] += 1
                            if nMacUse[7] == maxMachine[7]
                                notBusy7 = false
                            end
                        end
                    end
                    # At station 8
                    while notBusy8
                        if rand() <= 0.85
                            if (processInv[28,hour] > 0) && notBusy8
                                nProcess = min(speed[8], processInv[28,hour])
                                InvStations[2,hour:end] += nProcess #* 0.8
                                InvStations[4,hour:end] -= nProcess

                                processInv[29,hour:end] += nProcess #* 0.8
                                processInv[28, hour:end] -= nProcess

                                nMacUse[8] += 1
                                if nMacUse[8] == maxMachine[8]
                                    notBusy8 = false
                                end
                            end
                        else
                            nMacUse[8] += 1
                            if nMacUse[8] == maxMachine[8]
                                notBusy8 = false
                            end
                        end
                    end

                end
            end
            return finishedInv
        end
```

Out[15]: productACapacity (generic function with 1 method)

In [278]:
```
n = 100
hourW = round(Int64,((21 * 7) - 20) * 0.85)
machineSetup = [1 2 1 1 1 1 1 1]
capacity = zeros(n,1)
for i=1:n
    temp = productACapacity(machineSetup)
    capacity[i] += temp[end]
end
```

```
mean(capacity)
```

```
Out[278]: 193.69400000000002
```

```
In [282]: n = 100
          hourW = round(Int64,((21 * 7) - 20) * 0.85)
          machineSetup = [1 2 1 2 1 1 1 1]
          capacity = zeros(n,1)
          for i=1:n
              temp = productACapacity(machineSetup)
              capacity[i] += temp[end]
          end

          mean(capacity)
```

```
Out[282]: 250.04700000000014
```

```
In [291]: n = 100
          hourW = round(Int64,((21 * 7) - 20) * 0.85)
          machineSetup = [1 3 2 2 1 1 1 1]
          capacity = zeros(n,1)
          for i=1:n
              temp = productACapacity(machineSetup)
              capacity[i] += temp[end]
          end

          mean(capacity)
```

```
Out[291]: 390.3
```

```
In [300]: n = 100
          hourW = round(Int64,((21 * 7) - 20) * 0.85)
          machineSetup = [2 3 2 2 1 1 1 1]
          capacity = zeros(n,1)
          for i=1:n
              temp = productACapacity(machineSetup)
              capacity[i] += temp[end]
          end

          mean(capacity)
```

```
Out[300]: 431.9340000000001
```

```
In [309]: n = 100
          hourW = round(Int64,((21 * 7) - 20) * 0.85)
          machineSetup = [2 4 2 2 1 1 1 1]
          capacity = zeros(n,1)
          for i=1:n
              temp = productACapacity(machineSetup)
              capacity[i] += temp[end]
          end

          mean(capacity)
```

```
Out[309]: 449.728
```

```
In [318]: n = 100
          hourW = round(Int64,((21 * 7) - 20) * 0.85)
          machineSetup = [2 4 2 3 1 1 1 1]
          capacity = zeros(n,1)
          for i=1:n
              temp = productACapacity(machineSetup)
              capacity[i] += temp[end]
          end

          mean(capacity)

Out[318]: 619.723

In [7]: n = 100
        hourW = round(Int64,((21 * 7) - 20) * 0.85)
        machineSetup = [2 5 2 3 1 1 1 1]
        capacity = zeros(n,1)
        for i=1:n
            temp = productACapacity(machineSetup)
            capacity[i] += temp[end]
        end

        mean(capacity)

Out[7]: 666.895

In [8]: n = 100
        hourW = round(Int64,((21 * 7) - 20) * 0.85)
        machineSetup = [2 5 3 4 1 1 1 1]
        capacity = zeros(n,1)
        for i=1:n
            temp = productACapacity(machineSetup)
            capacity[i] += temp[end]
        end

        mean(capacity)

Out[8]: 691.0870000000002

In [9]: n = 100
        hourW = round(Int64,((21 * 7) - 20) * 0.85)
        machineSetup = [4 5 3 4 2 1 1 1]
        capacity = zeros(n,1)
        for i=1:n
            temp = productACapacity(machineSetup)
            capacity[i] += temp[end]
        end

        mean(capacity)

Out[9]: 774.061

In [10]: n = 100
         hourW = round(Int64,((21 * 7) - 20) * 0.85)
         machineSetup = [4 5 3 4 2 2 1 1]
         capacity = zeros(n,1)
```

```
        for i=1:n
            temp = productACapacity(machineSetup)
            capacity[i] += temp[end]
        end

        mean(capacity)
```

```
Out[10]: 838.8840000000004
```

```
In [11]: n = 100
         hourW = round(Int64,((21 * 7) - 20) * 0.85)
         machineSetup = [4 6 3 4 2 2 1 1]
         capacity = zeros(n,1)
         for i=1:n
             temp = productACapacity(machineSetup)
             capacity[i] += temp[end]
         end

         @show mean(capacity)
         @show std(capacity)
         ;
```

```
mean(capacity) = 1008.947
std(capacity) = 52.800687658133036
```

```
In [374]: n = 100
          hourW = round(Int64,((21 * 7) - 20) * 0.85)
          machineSetup = [4 6 3 5 2 2 1 1]
          capacity = zeros(n,1)
          for i=1:n
              temp = productACapacity(machineSetup)
              capacity[i] += temp[end]
          end

          mean(capacity)
```

```
Out[374]: 1068.2430000000004
```

```
In [16]: n = 1000
         hourW = round(Int64,((21 * 7) - 20) * 0.85)
         machineSetup = [4 6 3 5 2 2 1 1]
         capacity = zeros(n,1)
         for i=1:n
             temp = productACapacity(machineSetup)
             capacity[i] += temp[end]
         end

         mean(capacity)
```

```
Out[16]: 1068.1676999999988
```

```
In [17]: std(capacity)
```

```
Out[17]: 50.51137402224984
```

```
In [19]: using Gadfly
         p = Gadfly.plot(x=capacity, Geom.histogram(bincount=25),
```

```
        Guide.xlabel("Production Capacity"), Guide.title("Distribution of 1000 simulations of capacity
        Theme(background_color=color("white")))
        Gadfly.draw(PNG("productionDist.png", 6inch, 6inch), p)
```

In [ ]: