CVEN 339 – Spring 2007
Midterm Exam #1

Median 80
Mean 75.7
St. Dev. 12.0
High 99
Low 44

CVEN 339 Midterm #1 Spring 2007
1. Dr. Cahill is planning his new “Tony’s Authentic New York Honkytonk” to be located just over the county line. The water supply will be an onsite well (see the drawing on the next page). He needs to choose a well pump and has found several models in a catalogue, and the pump properties are given below. He estimates that the maximum demand in the establishment will be 25 gallons per minute (gpm), and he is concerned about having adequate water pressure.

For each pump model described below, determine whether the pump would be capable of supplying the needed flowrate and the water pressure in the Honkytonk if that model were used. (66 points)

<table>
<thead>
<tr>
<th>Model</th>
<th>Number of Impellers</th>
<th>Capable of Supplying Flowrate? (Yes/No)</th>
<th>Water Pressure in Honkytonk (lb/in²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP-2007-20</td>
<td>20</td>
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<td>WP-2007-60</td>
<td>60</td>
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<tr>
<td>WP-2007-100</td>
<td>100</td>
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</tbody>
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The WP-2007-XX well pump series are multi-stage (multi-impeller) pumps like the one shown in class. Each impeller has the following characteristic curve:

\[ y = -0.0013x^2 - 0.025x + 3 \]
Useful Conversions
1 ft³ = 7.481 gal
1 min = 60 sec
1 in = 25.4 mm
1 ft = 12 in
1 beagle = 2.3 chihuahuas
2. Highway 321 is built along the shore of Lake Sugarcube as shown in the drawing below. As shown in the drawing, two culverts have been installed under the highway to allow water to flow into the lake from the left side of the picture. What is the maximum flow that may pass through the two culverts together without water overtopping the roadway? (34 points)

Culvert #1 (bottom): 24 in diameter reinforced concrete pipe (ε = 2.2 mm)
167.4 ft long
mitered entrance, projecting exit

Culvert #2 (top): 24 in diameter corrugated metal pipe
144.3 ft long
projecting entrance, mitered exit