**Scenario:**

A division of a plastics company manufactures three basic products: sporks, packets, and school packs.

* A spork is a plastic utensil which purports to be a combination spoon, fork, and knife.
* Packets consist of a spork, a napkin, and a straw wrapped in cellophane.
* School packs are boxes of 100 packets with an additional 10 loose sporks included.

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| --- | --- | --- | --- | --- | --- |
| Sporks | 0.8 molding hours |  | 0.2 supervisory hours |  | $2.50 in direct costs. |
| Packets | 1 spork |  | 0.5 supervisory hours | 1.5 packaging hours | $4.00 in direct costs. |
| School packs | 10 sporks | 100 packets | 0.5 supervisory hours | 2.5 packaging hours | $8.00 in direct costs. |

* Spork price: $5.00,
* Packet Price: $15.00
* School Pack Price: $300.

There are 200 hours of production time in the coming month.

**Some prompts.  Note: you do not have to answer all of these -- these are just prompts to encourage discussion.**

* What are the appropriate decision variables? constraints? objectives?
* What might be important assumptions to state or consider?
* Is your formulation a linear programming problem, integer programming problem, non-linear programming problem, or other?
* Can you solve this in AMPL?  What is the solution?
* Can you conduct sensitivity analysis?

**SETS**

* **Products**: Sporks, Packets, School Packs
* **Stages:** Molding, Supervising, Packaging

**DECISION VARIABLES**

* The number of sporks, packets, and school packs to produce

**OBJECTIVE FUNCTION**

* Maximize total profit in a given month. Total profit equals the (price less the direct cost) multiplied by the associated (product).

**CONSTRAINTS**

* Aggregate production hours must not exceed 200 hours within the coming month, for each stage in **Stages**.
* Non-negativity of decision variables.

**ASSUMPTIONS**

* Decision variables must be integers (I.e., this model is an integer programming model).
* Assumes that no flaws in production are anticipated in the coming month. I.e., this model does not account for human error or manufacturing defects.
* Does not explicitly account for reduction in available supervisory due to PTO or sickness.
* Assumes that everything that is produced is sold.
* Each product has equal demand. For example, the model may suggest to not sell school packets, but they could be the most highly demanded product.

Since all variables are linear in parameters, this model may be solved using AMPL. If you were to solve it, you may also conduct sensitivity analysis to address the range of feasibility without changing the optimal solution (for each constraint) or determine the maximum incremental cost to pay if you were to produce more of any product.