KEY

Lots of Linear Programming

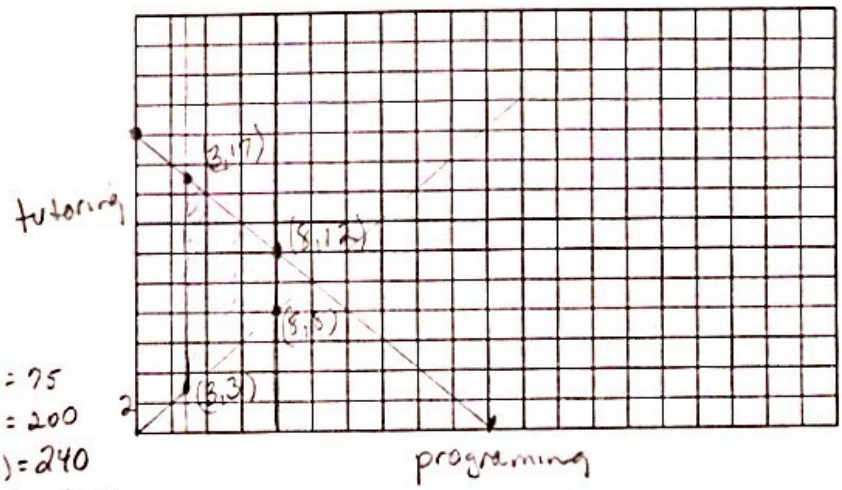
1. Betty works a maximum of 20 hours per week programming computers and tutoring English. She receives $15 per hour for programming and $10 per hours for tutoring. She wishes to work between 3 and 8 hours per week on programming, but always to give more time to tutoring than to programing. To maximize the amount she earns, how many hours should she work at each job?

$f(p,t) = 15p + 10t$

p-program
t-tutor $3 \le p \le 8$

$p + t \le 20$

$t > p$



$15(3)+10(3) = 75$
$15(8)+10(8) = 200$
$15(8)+10(12) = 240$
$15(3)+10(17) = 215$

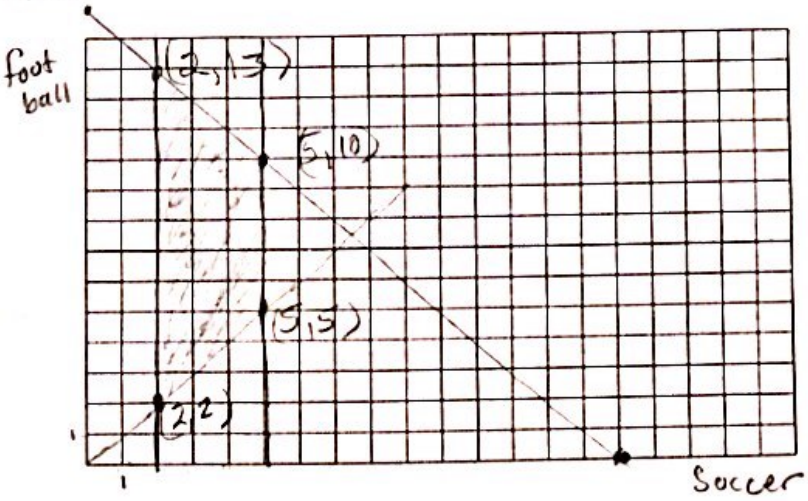
2. Josh practices football and soccer a maximum of 15 hours a week. He wishes to spend 2 to 5 hours a week on soccer. He always wants to give at least as much or more time to football than to soccer. Josh's uncle will give him $3 for every hour of football he practices. His grandmother will give him $4 for every hour he plays soccer. What is the maximum amount of money Josh can earn by playing these sports?

f is football
s is soccer

$f + s \le 15$

$2 \le \overset{\text{soccer}}{s} \le 5$

$f \ge s$



$g(s,f) = 4s + 3f$

$g(2,13) = 4(2) + 3(14)$
$= 8 + 42$
$= 50$

$g(5,10) = 5(5) + 3(10)$
$= 25 + 30$
$= 55$

5 hours of Soccer
10 hours of football
$55

But he should play for the love of the game!

3. A carpenter makes bookcases in two sizes, large and small. It takes 4 hours to make a large bookcase and 2 hours to make a small one. The profit on a large bookcase is $50.00 and the profit on a small bookcase is $20.00. the carpenter can spend only 24 hours per week making bookcases and must make at least 2 of each size per week. How many of each size must be made per week in order to provide maximum profit?

l - large
s - small

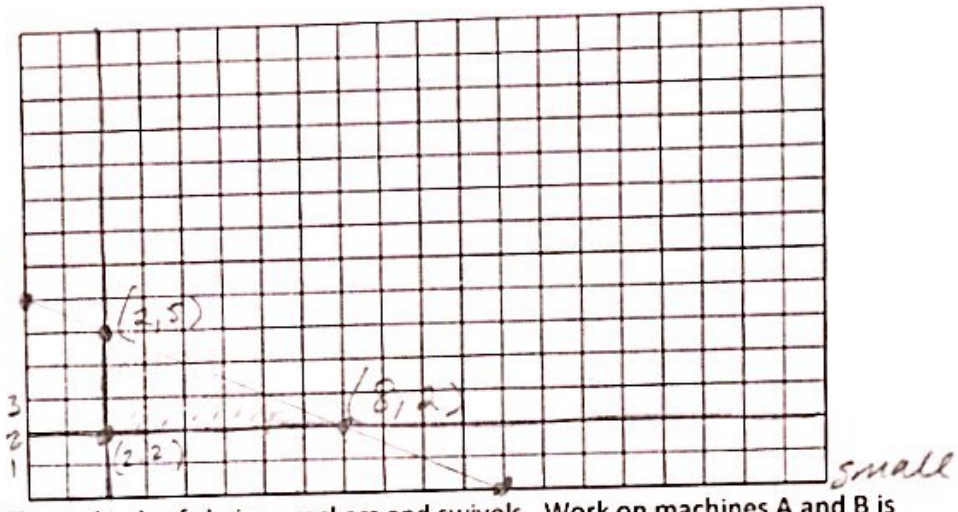
$4l + 2s \leq 24$

$l \geq 2$
$s \geq 2$

$P(s,l) = 20s + 50l$

$20(8) + 50(2) = 260$
$20(2) + 50(5) = 290$

2 small 5 large



4. Oaken Treasures makes two different kinds of chairs – rockers and swivels. Work on machines A and B is required to make both kinds of chairs. Machine A can run no more than 20 hours per day. Machine B is limited to 15 hours per day The chart below shows the amount of time on each machine that is required to make one chair and the profit from each chair.

Chair	Machine A	Machine B	Profit
Rocker	2 hours	3 hours	$12
Swivel	4 hours	1 hour	$ 10

r - rocker
s - swivel

How many chairs of each kind should Oaken Treasures make each day to maximize their profit?

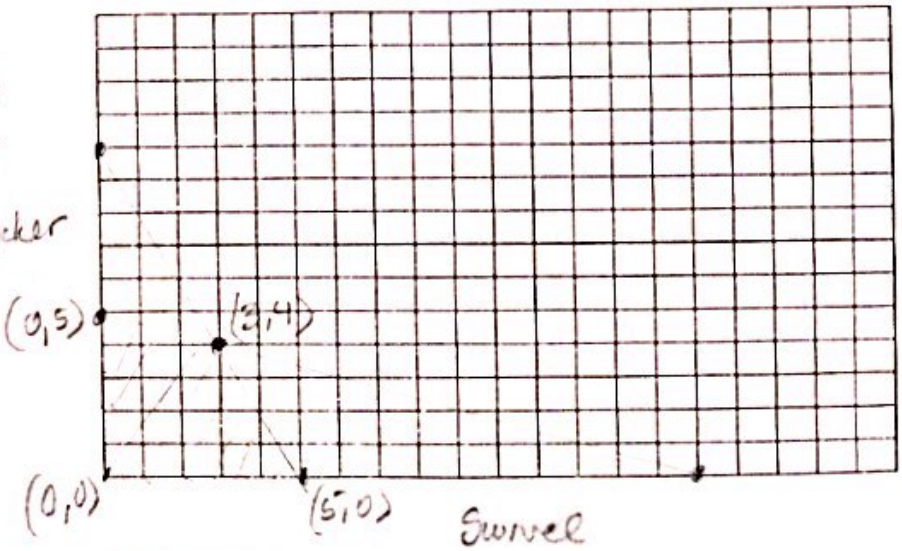
Mach A $2r + 4s \leq 20$
Mach B $3r + 1s \leq 15$

$P(s,r) = 10s + 12r$

$P(3,4) = 10(3) + 12(4)$
$= 30 + 48$
$= 78$

$P(5,0) = 10(5) + 0$
$= 50$

$P(0,5) = 10(0) + 12(5)$
$= 60$

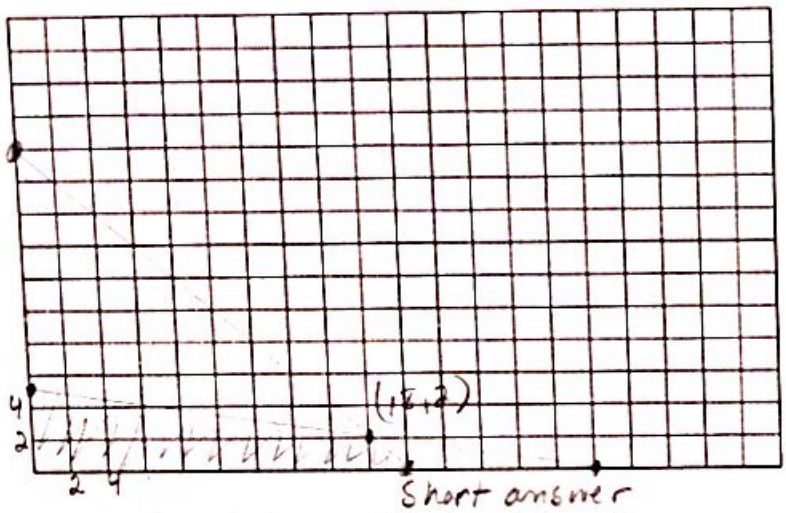


3 Swivel
4 Rocker

5. Your semester test in English consists of short answers and essay questions. Each short answer question is worth 5 points, and each essay question is worth 15 points. You may choose up to 20 questions of any type to answer. It takes 2 minutes to answer each short answer question and 12 minutes to answer each essay question. If you have one hour to complete the test, and assuming you answer all of the questions that you attempt correctly, how many of each type of question should you answer to earn the highest score?

short essay
$a + e \leq 20$

$2a + 12e \leq 60$



$f(a,e) = 5a + 15e$

$= 5(18) + 15(2)$

$= 80 + 30$

$= 110$

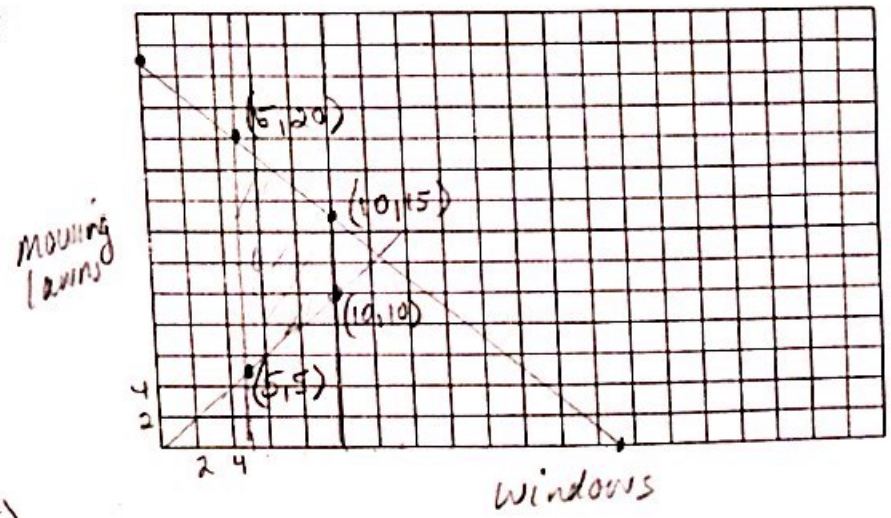
18 short
2 essays

6. Bob works a maximum of 25 hours per week mowing lawns and cleaning windows. He earns $12 per hour mowing lawns and $15 per hour washing windows. He wishes to work between 5 and 10 hours washing windows but always gives more time to mowing lawns. To maximize the amount of money that Bob earns, how many hours should he work at each job.

$m + w \leq 25$

$5 \leq w \leq 10$

$m > w$



$f(w,m) = 15w + 12m$

$f(10,10) = 15(10) + 12(10)$

$= 150 + 120$

$= 270$

$f(10,15) = 15(10) + 12(15)$

$= 150 + 180$

$= 330$

$f(5,20) = 15(5) + 12(20)$

$= 75 + 240$

$= 315$

10 hours on windows
15 hours mowing

7. Jill works a maximum of 22 hours per week cleaning houses and tutoring students. She earns $17 per hour cleaning houses and $13 per hour tutoring students. She wishes to work between 5 and 9 hours tutoring students but always give the same or more time to cleaning houses. To maximize the amount of money that Jill earns, how many hours should she work at each job.

h - house cleaning
t - tutoring

$h + t \leq 22$

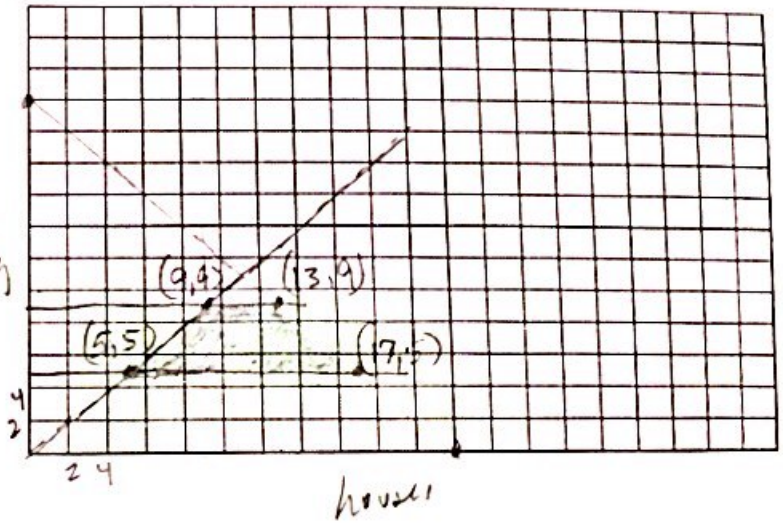
$5 \leq t \leq 9$

$h > t$

$f(h,t) = 17h + 13t$

$f(17,5) = 17(17) + 13(5)$
$= 289 + 65$
$= 354$

$f(13,9) = 17(13) + 13(9)$
$= 221 + 117$
$= 338$



17 hrs on house cleaning
5 hrs on tutoring

Extra credit (use graph paper if desired) Problem from Quiz

Delores arrives at school late because her car broke down, and therefore, has only 45 minutes to complete a history exam. The exam has 2 open-ended questions and 30 multiple-choice questions. Each correct open-ended question is worth 20 points, and each multiple-choice question is worth 2 points. She knows that it usually takes her 15 minutes to answer an open-ended question and only one minute to answer a multiple-choice question. Assume that for each question Delores answers, she receives full credit. How many of each type of question should she answer to receive the maximum possible points? What is the maximum possible points that Delores can receive?

e - open ended
m - mult choice

$f(e,m) = 20e + 2m$

$15e + 1m \leq 45$

$e \leq 2$

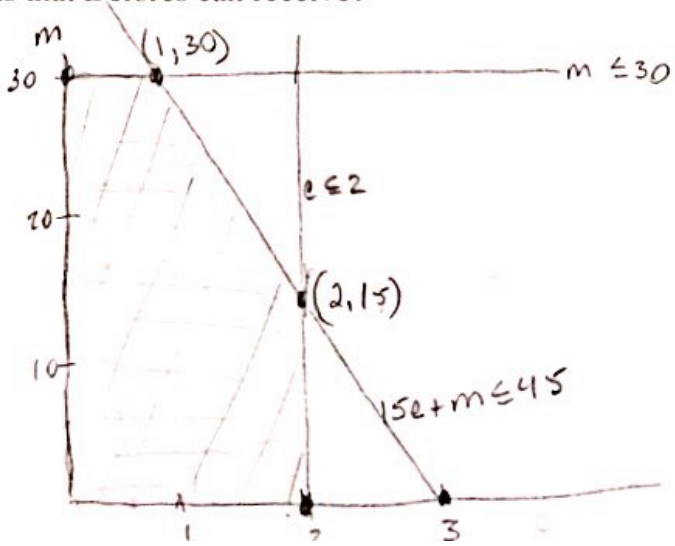
$m \leq 30$

$20(2) + 2(15)$

70

Answer → $20(1) + 2(30)$

80



1 essay for 20pts
30 MC for 60 pts
80pts

$15(2) + m \leq 45$

$m \leq 15$

$15e + 30 \leq 45$

$15e \leq 15$

$e \leq 1$