Ec 172C - OPERATIONS RESEARCH
Foster, UCSD, Friday, 28 OCT 2005

Name: $\qquad$
ID: $\qquad$

## MIDTERM EXAM

Open notes; calculator ok. Put answers in space provided. SHOW WORK for partial credit and to avoid allegations of cheating. Carry 3+ decimal places in calculations.

| $\operatorname{Pr} 1$ |  | 25 |
| ---: | ---: | ---: |
| $\operatorname{Pr} 2$ |  | 25 |
|  |  | $/ 50$ | Point values of questions in [bold brackets].

## Problem 1

Figure 1 shows a telegraph network c. 1900. Numbers on arcs represent bi-directional flow capacities (word groups/hour). A budding wire service wants to maximize the number of groups that can be sent from Chicago to Omaha. [18,4,3]

| Table 1 - Arc Flows | Flow |
| :--- | :--- |
| Minn. To Sioux Falls | - |
| Chicago to Kansas City <br> Lincoln to Omaha | - |

- Find the maximum. Max Flow = $\qquad$ groups/hour
- Draw the minimum cut on the diagram in Figure 1.
- Record arc flows listed in Table 1. Answers must match work shown in worksheet below.


| Route | Flow | Total |
| :---: | :---: | :---: |
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## Problem 2

The Cozumel Relief Authority has 4 work teams which can each be assigned to one of three preparedness activities. Lives saved in the event of storm disruption as a function of teams assigned to activities are in Table 2.
Find (and record in Table 3) an assignment of teams to activities to maximize total potential lives saved. [25]

| Table 2 | Food/Water <br> Storage | Medical <br> Facilities | Evacuation <br> Vehicles |
| :---: | :---: | :---: | :---: |
| Teams | 200 | 50 | 80 |
| 1 | 300 | 210 | 120 |
| 2 | 380 | 360 | 320 |
| 3 | 410 | 390 | 450 |
| 4 | 415 | 400 | 475 |


| EVAC. | $\mathrm{V}\left(\mathrm{s}_{3}, \mathrm{~d}_{3}\right)=\mathrm{f}\left(\mathrm{s}_{3}, \mathrm{~d}_{3}\right)+\mathrm{V}^{*}\left(\mathrm{~s}_{4}\right)$ |  |  |  |  |  | Maximum |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\left\{\mathrm{s}_{3}\right\} \mathrm{D}\left\{\mathrm{s}_{3}\right\}$ | 0 | 1 | 2 | 3 | 4 | $\mathrm{~V}^{*}\left(\mathrm{~s}_{3}\right)$ | $\mathrm{d}_{3}{ }^{*}$ |  |
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| MED. | $\mathrm{V}\left(\mathrm{s}_{2}, \mathrm{~d}_{2}\right)=\mathrm{f}\left(\mathrm{s}_{2}, \mathrm{~d}_{2}\right)+\mathrm{V}^{*}\left(\mathrm{~s}_{3}\right)$ |  |  |  |  |  | Maximum |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\left\{\mathrm{s}_{2}\right\} \mathrm{D}\left\{\mathrm{s}_{2}\right\}$ | 0 | 1 | 2 | 3 | 4 | $\mathrm{~V}^{*}\left(\mathrm{~s}_{2}\right)$ | $\mathrm{D}_{2}{ }^{*}$ |  |
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| FOOD | $\mathrm{V}\left(\mathrm{s}_{1}, \mathrm{~d}_{1}\right)=\mathrm{f}\left(\mathrm{s}_{1}, \mathrm{~d}_{1}\right)+\mathrm{V}^{*}\left(\mathrm{~s}_{2}\right)$ |  |  |  |  | Maximum |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\left\{\mathrm{s}_{1}\right\} \mathrm{D}\left\{\mathrm{s}_{1}\right\}$ | 0 | 1 | 2 | 3 | 4 | $\mathrm{~V}^{*}\left(\mathrm{~s}_{1}\right)$ | $\mathrm{D}_{1}{ }^{*}$ |
|  |  |  |  |  |  |  |  |


| Table 3 -- Results |  |  |  |
| :---: | :---: | :---: | :---: |
| Lives saved $=\ldots$ | Food/Water | Med. Fac. | Evac. Veh. |
| Teams Assigned |  |  |  |

