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**Task 1: Processor release (for those who were not at the lecture)**

#### Processor release involves releasing new modifications Task 1. Processor release

Processor Release expects to produce new modifications of processors at 4 of its facilities that currently have excess production capacity. It is expected to produce four different models of processors with higher frequencies: Celeron, Pentium III, Pentium 4 and Xeon 4, which will generate profits: 25, 40, 130 and 300 c.u.u.

Each model requires different areas to store silicon wafers arriving once a month in ultra-clean rooms until the

launch into operation: 1.1, 1.5, 1.8 and 2.1 m2 per 1000 processors of each type, respectively. The labor time costs for the production of these products at the four enterprises and warehouse space are given in the table.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Costs of working time of the enterprise (hours)  for the production of 1000 units | | | | Area of available warehouses, m2 |
| Celeron | Pentium III | Pentium 4 | Xeon 4 |
| Fab 11 | 0,6 | 0,7 | 0,5 | 0,5 | 800 |
| Fab 12 | 0,65 | 0,65 | 0,8 | 0,5 | 950 |
| Fab 30 | 0,37 | - | 0,47 | 0,9 | 1200 |
| Fab 32 | - | - | 0,42 | 0,8 | 500 |

The monthly market demand volumes for each model are 1100, 300, 400 and 200 thousand units respectively. The companies can work 12 hours per day with 26 working days per month.

What number of items of each model must be produced at each plant to make the greatest profit?

**Task 2: Optimal plan for development of software products**

Corvette manufactures and sells software on CD-ROMs. The company is evaluating the possibility of developing six new software applications. The table presents information on costs and expected profit from the sale of applications (in thousands of dollars).

|  |  |  |  |
| --- | --- | --- | --- |
| appendix | Development costs | Number of programmers | Net income |
| П1 | 400 | 6 | 2000 |
| П2 | 1100 | 18 | 3600 |
| П3 | 940 | 20 | 4000 |
| П4 | 760 | 16 | 3000 |
| П5 | 1260 | 28 | 4400 |
| П6 | 1800 | 34 | 6200 |
| Resources | 3500 | 60 |  |

Corvette has 60 programmers. The firm can allocate $3.5 million for the development of new software applications.

What is the optimal set of applications that should be developed?

Additional terms and conditions

1. It is expected that customers interested in Annex 4 will also be interested in Annex 5, and vice versa; therefore, the two applications should be developed or not developed together;
2. the development of annex 1 only makes sense if annex 2 is in place, so if annex 1 is developed, annex 2 must also be developed;
3. only one of Annexes 3 or 6 may be developed;
4. striving to ensure product quality, Korvet is not inclined to develop more than three software products.

Analyze the effect of each constraint on the optimal solution.

**Task 3. Optimization of investment portfolio**

A private investor expects to invest 500 thousand rubles in various securities (see table.).

|  |  |  |
| --- | --- | --- |
| Attachments | Income % | Risk |
| **A** shares | 15 | high |
| Shares **In.** | 12 | average |
| **C** Shares | 9 | low |
| Long-term bonds | 11 |  |
| short-term bonds | 8 |  |
| Term deposit | 6 |  |

After consulting with stock market specialists, he selected 3 types of stocks and 2 types of government bonds. Part of the money is supposed to be deposited in a term deposit in a bank.

With qualitative portfolio diversification considerations and informalizable personal preferences in mind, the investor makes the following portfolio requirements:

* all 500 thousand rubles must be invested;
* at least 100 thousand rubles must be on a time deposit in a bank.
* at least 25% of funds invested in equities must be invested in low-risk stocks;
* you should invest at least as much in bonds as in stocks.
* No more than 125 thousand rubles should be invested in securities with a yield of less than 10%.

1 Determine the investor's portfolio of securities that satisfies all requirements and maximizes annual income. What is the value of this income?

2. If an investor invests additional funds in a portfolio of securities while maintaining the above constraints, how will the expected annualized return change? Does the change in annualized return depend on the amount of additional funds invested? Why?

#### Task 4. Credit policy of the bank

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Thriftem Bank, which provides a full range of banking services, is located in  in the process of building a $12 million loan portfolio  The table summarizes the possible types of bank loans. | | | | | | | |  |
|  | | | | | | | |  |
| |  |  |  | | --- | --- | --- | | Loan type | interest rate | Probability of bad debts | | Loans to individuals | 0,14 | 0,1 | | Car loans | 0,13 | 0,07 | | Home equity loans | 0,12 | 0,03 | | Agricultural | 0,125 | 0,05 | | Commercial | 0,1 | 0,02 | |  |  |  |  |  |  |  |  |

Bad debts are considered unrecoverable, so they must be deducted from possible income. Competition with other financial institutions forces the bank to place at least 40% of its capital in agricultural and commercial loans. To assist the construction industry in its region, the bank plans to put at least 50% of its total personal, auto and home loans home equity loans. The bank also supports state policy indicating that the ratio of bad debts to total loans should not exceed 0.04. Find the optimal loan portfolio.