Question1:
The size (that is, the effort needed to complete it) of any task will depend on its characteristics. The units into which the work is divided will also differ. Identify the factors affecting the size of the task and work units for the following activities:

1. installing computer workstations in a new office;
2. transporting assembled personal computers from the factory where they were assembled to warehouses distributed in different parts of the country;
3. typing in and checking the correctness of data that is populating a new database;

4. system testing a newly written software application.

1. Installing computer workstations in a new office:

- Number of workstations to be installed
- Location of the new office and availability of resources
- Difficulty level of the installation process
- Number of available technicians to complete the task

Work units:

- Number of workstations installed per day
- Time spent on each workstation installation

2. Transporting assembled personal computers from the factory to warehouses:

- Number of computers to be transported
- Distance between the factory and warehouses
- Availability of transportation means
- Cost of transportation
- Conditions of the transportation route

Work units:

- Number of computers transported per day
- Distance travelled per day

3. Typing in and checking the correctness of data in a new database:

- Number of records to be entered
- Complexity of the data being entered
- Number of people available to enter the data
- Speed of data entry per person
- Time allowed for checking the accuracy of the data

Work units:

- Number of records entered per hour
- Number of errors per hour

4. System testing a newly written software application:

- Complexity of the software
- Number of available testers
- Time allocated for testing
- Number of bugs found during testing
- Difficulty of fixing the bugs

Work units:

- Number of tests run per day
- Number of bugs found per day

### Question 2

If you were asked as an expert to provide an estimate of the effort needed to make certain changes to an existing piece of software, **what information** would you like to have to hand to assist you in making that estimate?

### Answer

A software developer would like to have the following information to make an accurate estimate of the effort required to make changes to existing software:

1. **Requirements:** Detailed description of the changes that need to be made and the desired outcome.
2. **Codebase:** Access to the existing codebase and knowledge of the technologies and architecture used.
3. **Dependencies:** Information on any existing dependencies and their impact on the changes.
4. **Time Constraints:** Deadlines for delivery and any time constraints for the project.
5. Resources: Availability of required resources, including hardware and team members.
6. **Previous Efforts**: Information on any previous attempts to make similar changes and the reasons for their failure.
7. **Environment:** Information on the development environment, including operating systems, databases, and other relevant tools.

Having this information will help a software developer to make an informed estimate of the effort required to make the desired changes to the existing software.

Question 3:

Question

A small application maintains a telephone directory. The database for the application contains the following data types:

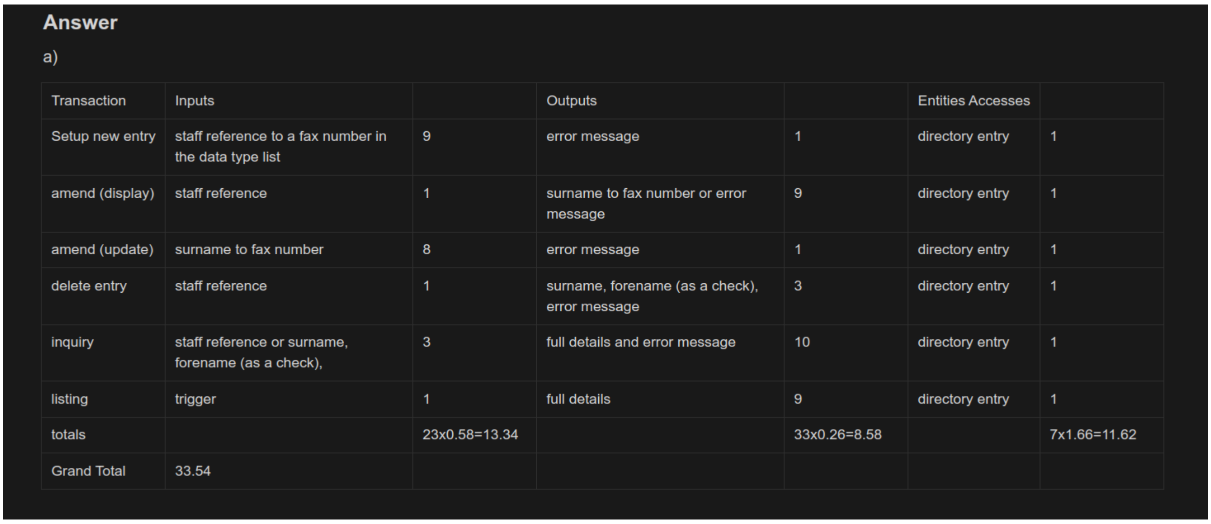
1. Staff reference
2. Surname
3. Forenames
4. Title
5. Department code
6. Room number
7. Telephone extension
8. E-mail address
9. Fax number

Transactions are needed which:

1. set up new entries;
2. amend existing entries;
3. delete entries;
4. allow enquirers to list online the details for a particular member of staff;
5. produce a complete listing of the telephone directory entries in alphabetical order.

a. Use this scenario to produce an estimated Mark II FP count. List all the assumptions you will need to make.

b. Another requirement could be to produce the listing in (v) in departmental order. In your view, should this increase FP count and if so by how much?

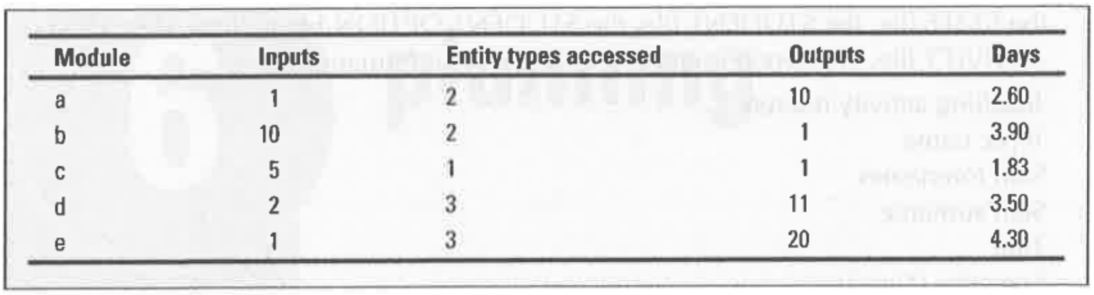


Answer

a)

Transaction	Inputs		Outputs		Entities Accesses	
Setup new entry	staff reference to a fax number in the data type list	9	error message	1	directory entry	1
amend (display)	staff reference	1	surname to fax number or error message	9	directory entry	1
amend (update)	surname to fax number	8	error message	1	directory entry	1
delete entry	staff reference	1	surname, forename (as a check), error message	3	directory entry	1
inquiry	staff reference or surname, forename (as a check),	3	full details and error message	10	directory entry	1
listing	trigger	1	full details	9	directory entry	1
totals		23x0.58=13.34		33x0.26=8.58		7x1.66=11.62
Grand Total	33.54					

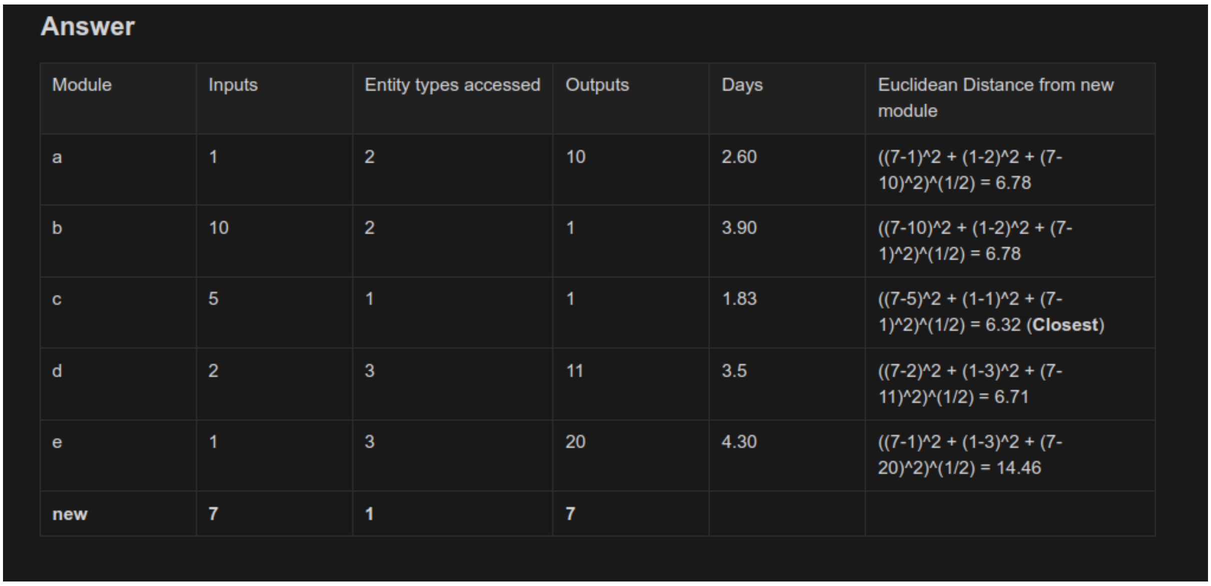
4 The following details are held about previously developed software modules.



Module	Inputs	Entity types accessed	Outputs	Days
a	1	2	10	2.60
b	10	2	1	3.90
c	5	1	1	1.83
d	2	3	11	3.50
e	1	3	20	4.30

A new module has 7 inputs, 1 entity type access and 7 outputs. Which of the modules a to e is the closest analogy in terms of Euclidean distance?

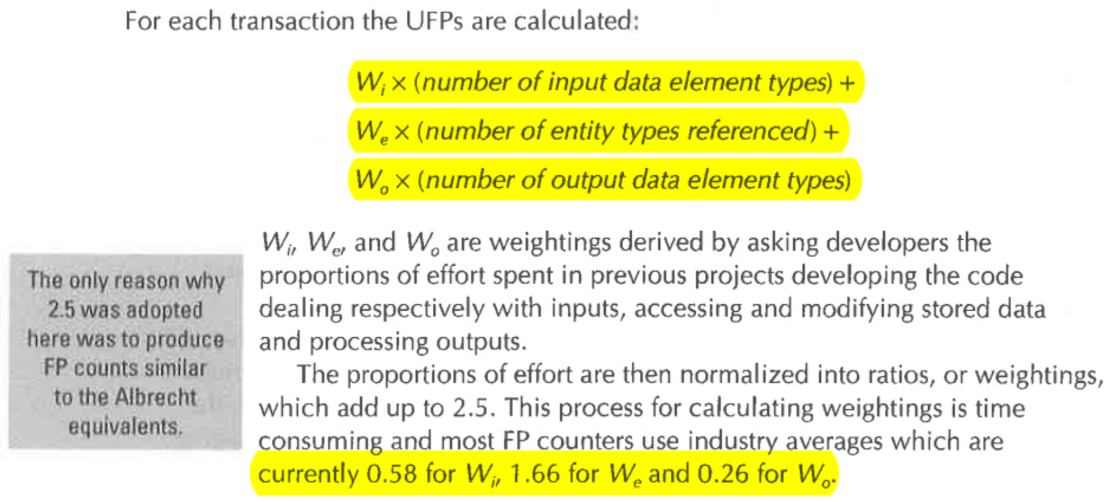
$$\mathit{distance} = \mathit{square\text{-}root\ of}\ ((\mathit{target\_parameter}_1 - \mathit{source\_parameter}_1)^2 + \\ \ldots (\mathit{target\_parameter}_n - \mathit{source\_parameter}_n)^2)$$



Answer

Module	Inputs	Entity types accessed	Outputs	Days	Euclidean Distance from new module
a	1	2	10	2.60	((7-1)^2 + (1-2)^2 + (7-10)^2)^(1/2) = 6.78
b	10	2	1	3.90	((7-10)^2 + (1-2)^2 + (7-1)^2)^(1/2) = 6.78
c	5	1	1	1.83	((7-5)^2 + (1-1)^2 + (7-1)^2)^(1/2) = 6.32 (**Closest**)
d	2	3	11	3.5	((7-2)^2 + (1-3)^2 + (7-11)^2)^(1/2) = 6.71
e	1	3	20	4.30	((7-1)^2 + (1-3)^2 + (7-20)^2)^(1/2) = 14.46
new	**7**	**1**	**7**		

Question 5: Using the data in further exercise 4 above, calculate the Symons Mark II FPs for each module. Using the results, calculate the effort needed for the new module described in further exercise 4. How does this estimate compare to the one based on analogy?



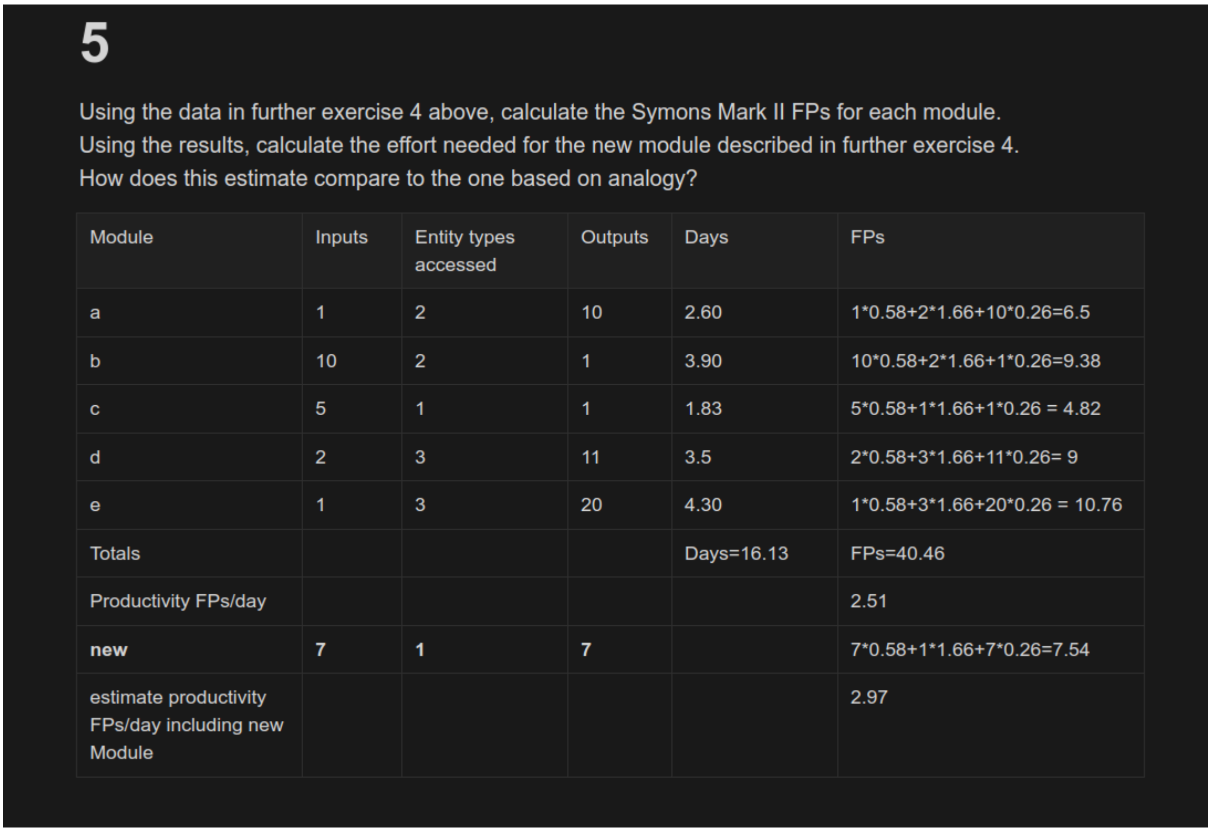
For each transaction the UFPs are calculated:

$$W_i \times (\textit{number of input data element types}) +$$
$$W_e \times (\textit{number of entity types referenced}) +$$
$$W_o \times (\textit{number of output data element types})$$

W_i, W_e, and W_o are weightings derived by asking developers the proportions of effort spent in previous projects developing the code dealing respectively with inputs, accessing and modifying stored data and processing outputs.

The proportions of effort are then normalized into ratios, or weightings, which add up to 2.5. This process for calculating weightings is time consuming and most FP counters use industry averages which are currently 0.58 for W_i, 1.66 for W_e and 0.26 for W_o.

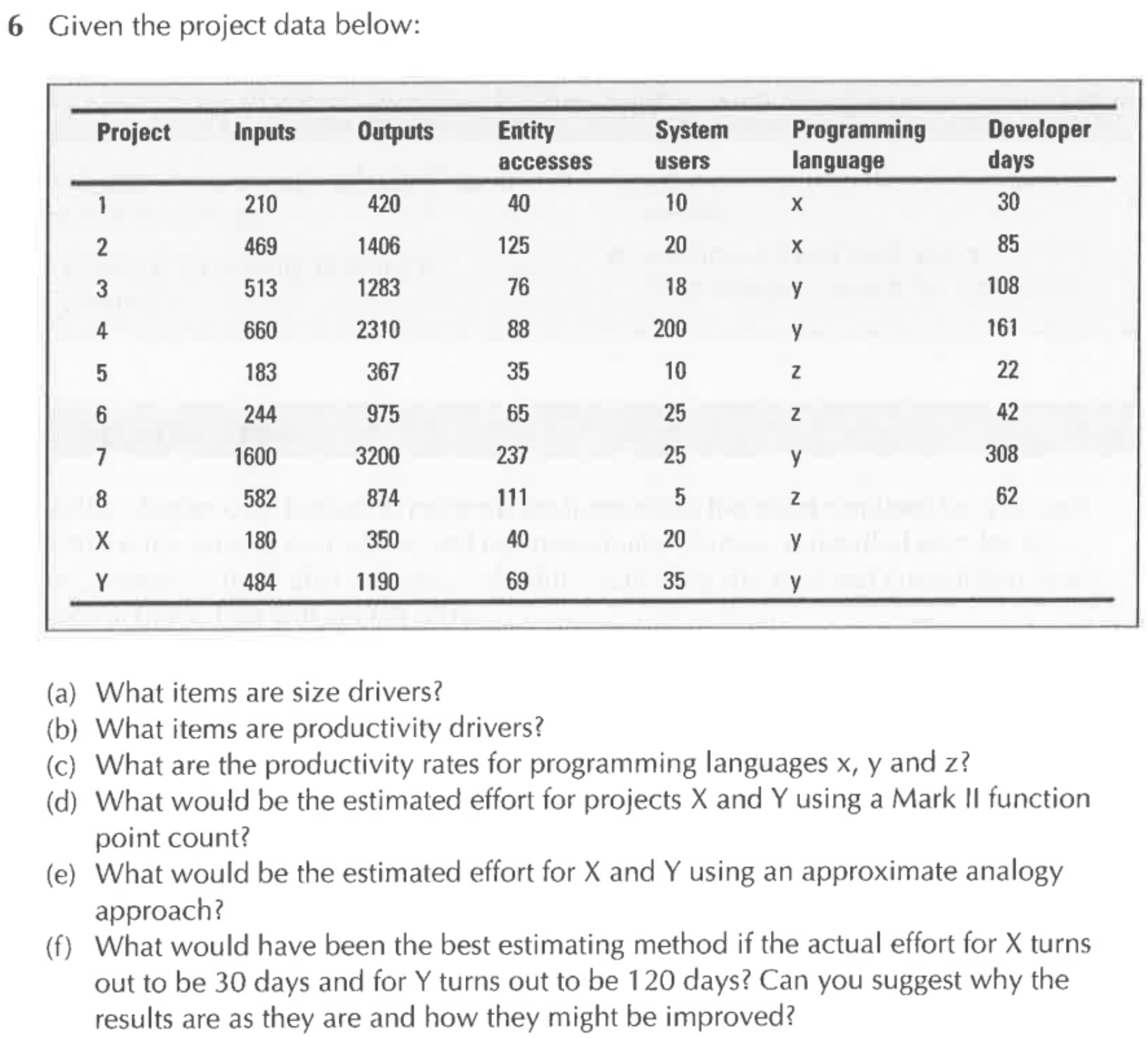
The only reason why 2.5 was adopted here was to produce FP counts similar to the Albrecht equivalents.



5

Using the data in further exercise 4 above, calculate the Symons Mark II FPs for each module.
Using the results, calculate the effort needed for the new module described in further exercise 4.
How does this estimate compare to the one based on analogy?

Module	Inputs	Entity types accessed	Outputs	Days	FPs
a	1	2	10	2.60	1*0.58+2*1.66+10*0.26=6.5
b	10	2	1	3.90	10*0.58+2*1.66+1*0.26=9.38
c	5	1	1	1.83	5*0.58+1*1.66+1*0.26 = 4.82
d	2	3	11	3.5	2*0.58+3*1.66+11*0.26= 9
e	1	3	20	4.30	1*0.58+3*1.66+20*0.26 = 10.76
Totals				Days=16.13	FPs=40.46
Productivity FPs/day					2.51
new	**7**	**1**	**7**		7*0.58+1*1.66+7*0.26=7.54
estimate productivity FPs/day including new Module					2.97



6 Given the project data below:

Project	Inputs	Outputs	Entity accesses	System users	Programming language	Developer days
1	210	420	40	10	x	30
2	469	1406	125	20	x	85
3	513	1283	76	18	y	108
4	660	2310	88	200	y	161
5	183	367	35	10	z	22
6	244	975	65	25	z	42
7	1600	3200	237	25	y	308
8	582	874	111	5	z	62
X	180	350	40	20	y	
Y	484	1190	69	35	y	

(a) What items are size drivers?

(b) What items are productivity drivers?

(c) What are the productivity rates for programming languages x, y and z?

(d) What would be the estimated effort for projects X and Y using a Mark II function point count?

(e) What would be the estimated effort for X and Y using an approximate analogy approach?

(f) What would have been the best estimating method if the actual effort for X turns out to be 30 days and for Y turns out to be 120 days? Can you suggest why the results are as they are and how they might be improved?

### Answer

1. The size drivers among these items are:
- inputs
- outputs
- entity accesses

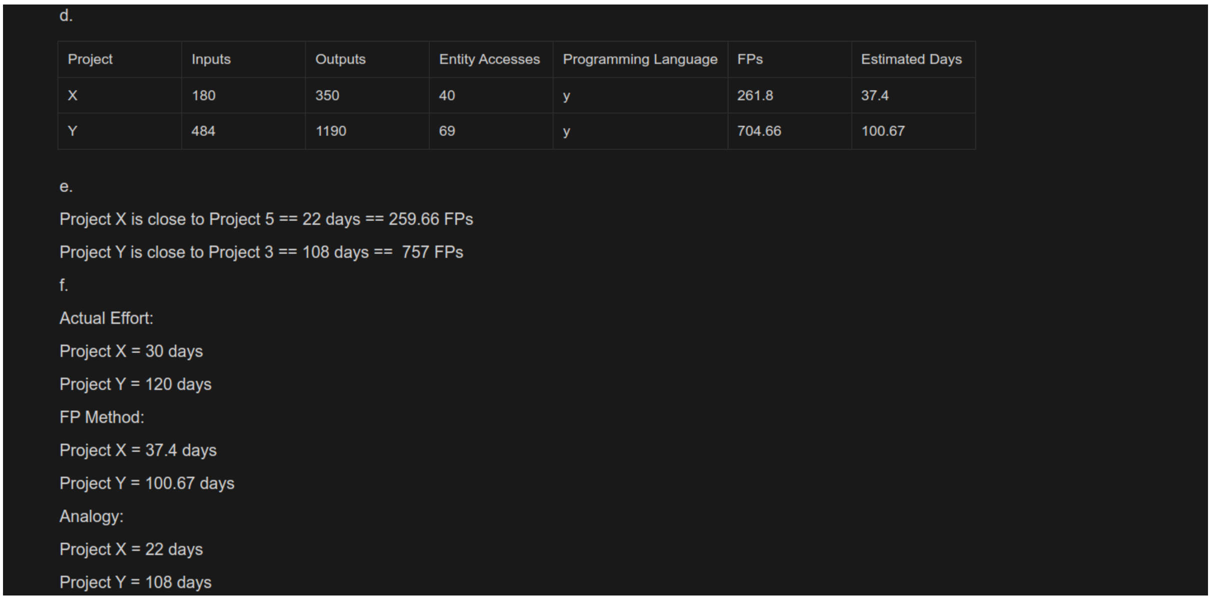
These three items would determine the amount of data processing and storage needed, leading to an increase in the size of the system.

b. Programming Language - the number of lines of code that can be produced in a day will depend, in part, on the programming language.

c.

x = 9.93 FPs/days = ((210+469)*0.58+(420+1406)*0.26+(40+125)*1.66)/(30+85)

y = 7 FPs/days = ((513+660+1600)*0.58+(1283+2310+3200)*0.26+(76+88+237)*1.66)/(108+161+308) z = 12 FPs/days = ((183+244+582)*0.58+(367+975+874)*0.26+(35+65+111)*1.66)/(22+42+62)



d.

Project	Inputs	Outputs	Entity Accesses	Programming Language	FPs	Estimated Days
X	180	350	40	y	261.8	37.4
Y	484	1190	69	y	704.66	100.67

e.

Project X is close to Project 5 == 22 days == 259.66 FPs

Project Y is close to Project 3 == 108 days == 757 FPs

f.

Actual Effort:

Project X = 30 days

Project Y = 120 days

FP Method:

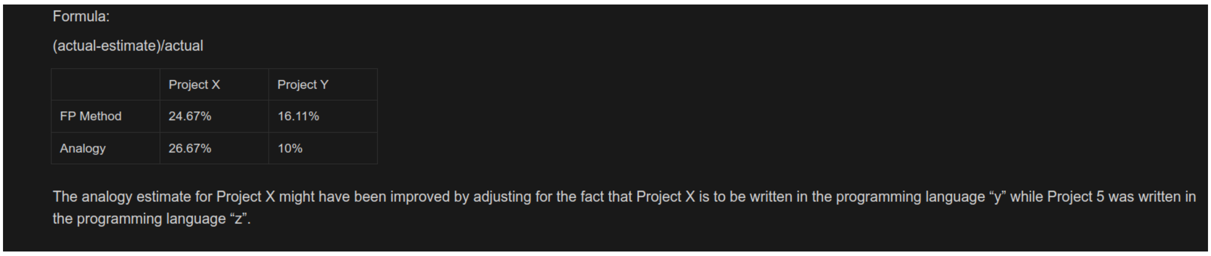
Project X = 37.4 days

Project Y = 100.67 days

Analogy:

Project X = 22 days

Project Y = 108 days



Formula:

(actual-estimate)/actual

	Project X	Project Y
FP Method	24.67%	16.11%
Analogy	26.67%	10%

The analogy estimate for Project X might have been improved by adjusting for the fact that Project X is to be written in the programming language “y” while Project 5 was written in the programming language “z”.