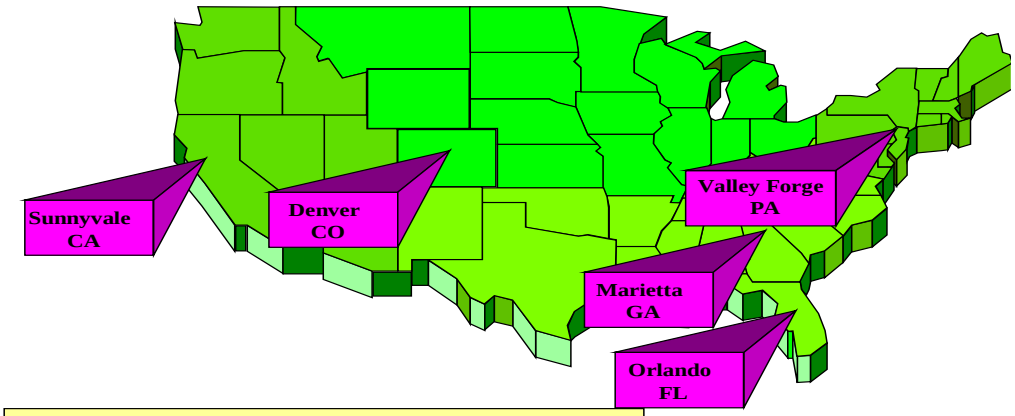
NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
VAALDRIEHOEKKAMPUS

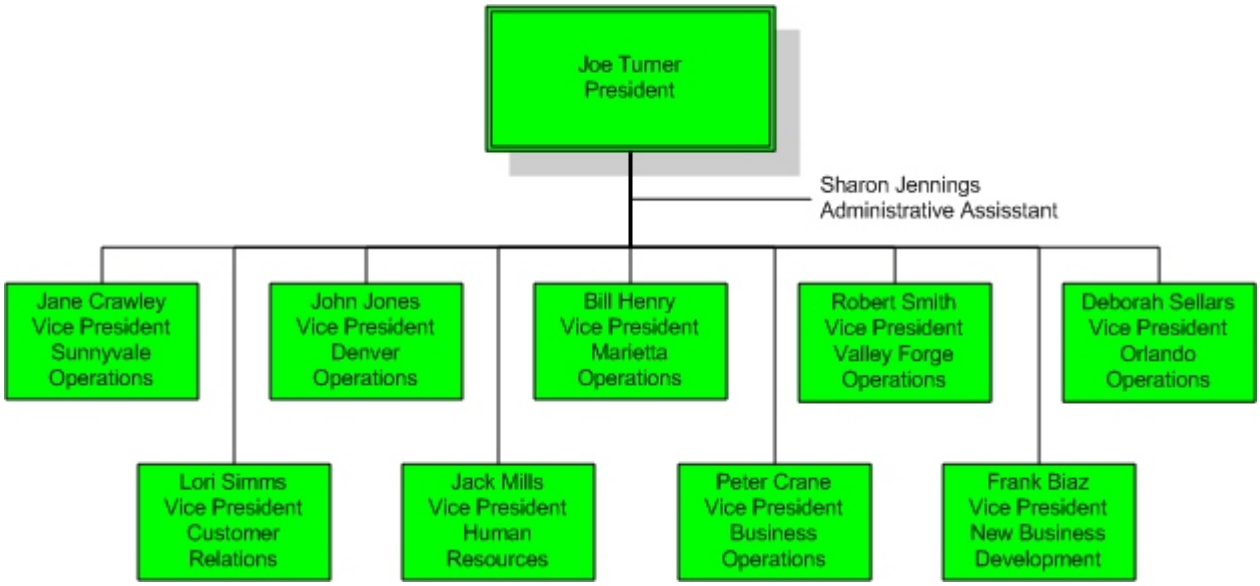
``````

| Benodigdhede vir hierdie vraestel / Requirements for this paper: | | | | Oopboek eksamen / Open book examination: | |
|---|---|---|---|---|---|
| Multikeusekaarte / Multi choice cards: | | Nie-programmeerbare sakrekenaar / Non-programmable calculator: | | | |
| Grafiekpapier / Graphic paper: | | Draagbare rekenaar / Laptop: | | | |

| | | | |
|---|---|---|---|
| EKSAMEN / EXAMINATION: | **Eerste Geleentheid / First Opportunity June 2015** | KWALIFIKASIE / QUALIFICATION: | **B.Sc.(IT)** |
| MODULEKODE / MODULE CODE: | **ITRW213** | DUUR / DURATION: | **3 Ure / Hours** |
| MODULE BESKRYWING / SUBJECT: | **Systems Analysis & Design I / Stelselontleding & -ontwerp I** | MAKS / MAX: | **100** |
| EKSAMINATOR(E) / EXAMINER(S): | **Imelda Smit** | DATUM / DATE: | **17/06/2015** |
| MODERATOR(E) / MODERATOR(S): | **Prof Roelien Goede** | TYD / TIME: | **14:00** |

**Answer all the questions. ★ *Beantwoord al die vrae.***

**Read the case study before answering the questions | Lees die gevallestudie voordat jy die vrae beantwoord:**

### *Case Background*

A-1 Information Systems (IS) headquartered in Orlando, Florida, employs approximately 4,100 employees throughout the United States. A-1 IS provides leading edge technologies, distributed computing, mainframe, micro, communication, and consulting services to its parent company A-1 Corporation, headquartered in Bethesda, Maryland, as well as to external customers including the U.S. government. In addition A-1 IS is responsible for the development and support of all the internal systems that support their day-to-day business processes and operations.

A-1 IS currently operates in five sites across the USA and they are as follows:




| | |
|---|---|
| **Sunnyvale, CA -** | **725 employees** |
| **Denver, CO -** | **770 employees** |
| **Valley Forge, PA -** | **1,056 employees** |
| **Marietta, GA -** | **171 employees** |
| **Orlando, FL -** | **1,475 employees** |
``````

Each site is responsible for servicing and supporting the customers in its region as well as its internal employees.

A-1 IS has experienced a 15% increase in employees over the past two years, and long-range projections show that trend continuing for the next three years.

Organisation Structure

A-1 Information Systems



Information Systems Facilities

The information architecture for A-1 IS uses the following standards:

- Desktop PC— IBM ThinkCentre S series
  Pentium 4 processor
  512 megabytes of RAM
  80 GB disk drive
  17 or 19 inch monitors
  Operating system — MS Windows XP Pro
  Standard Tools — MS Office suite (2003)
  Internet Browser — IE 6
  Virus Protection — Norton AV
  E-mail — MS Outlook
- Servers — IBM xSeries 336
  Intel Xeon processor
  4 GB of RAM (16GB in Orlando)
  200 GB in hard disk storage (via RAID 5 configuration)
  Operating system — MS Windows Server 2003
  Database Management System — Oracle 10g
- Printers — Hewlett Packard LaserJet and PaintJet classes.
- LAN – Each office employs a wired and wireless Ethernet LAN
- WAN – A VPN connects each office to the main office in Orlando

Notes:

Each site has comparable hardware and software, and the employee to micro ratio is 1-to-1.

Many employees, including most managers, use IBM notebooks with docking stations as their desktop computer. Each notebook is comparable to Gateway desktop specifications.

The Problem

Due to the tremendous growth the company has experienced in recent years, it has recognized that to ensure the continued success of servicing internal as well as external customers, it needed to develop a strategic plan and vision for the use and modernization of its computing resources. The challenges of creating centralized systems across all five IS-sites to support business practices that are common if not identical across the sites, further emphasize the need.

In January 2005 a strategic plan to modernize the company's resources was presented to executive management. This document included a multi-phased plan to reengineer the current systems to use state-of-the-art technology and to provide a showcase of systems that eventually could be delivered across the whole corporation.

Phase 1 of the plan consisted of reengineering all systems related to Human Resources, which included employee information, time and attendance, and payroll. **Task 1 of this phase is the development of the Employee Self-Service System (ESSS), a system that will house the repository of employee master data.** *This system would provide the capability for each employee to maintain his or her own information regarding address and telephone numbers, emergency contact information, payroll deduction options, and savings bond purchases.*

Current practices now have each of these changes being processed by an extensive manual effort in which Human Resource administrators fill out forms and input the data. This manual effort often results in a time lag of several days between the time the employee submits the forms and the update of the information in the computer. This delay has caused several problems, including unacceptable lag time in implementing payroll deduction changes and company mailings (including pay checks) being sent to the wrong address. Another problem of the present system is the employee directory, which is printed every six months. It seems to be out-of-date as soon as it arrives with missing information on new employees, and incorrect information on employees who have changed addresses or been transferred.

The plan for the new system is to provide the capability for an employee to update data themselves in real time, the problems mentioned above can be reduced, if not eliminated. The printed employee directory will be replaced by an intranet-based online directory that will be driven by the ESSS database and always up-to-date.

QUESTION / VRAAG 1 [CONTEXT | KONTEKS] [19]

1.1 Make a list of the stakeholders listed in the case study. Indicate the stakeholder classification of each one. Use a table to present your answer. *You may use the organograms in the case study and in Appendix A.*	5	1.1 Maak 'n lys van belanghebbendes waarna verwys word in die gevallestudie. Dui aan wat die belanghebbende klassifikasie van elkeen is. Gebruik 'n tabel om jou antwoord voor te stel. *Jy mag die organogramme in die gevalestudie en Bylae A gebruik.*
1.2 Kira needs to explain the lifetime of a system to Joe. Supply her with a drawing that explains it.	5	1.2 Kira moet die lewensduur van 'n stelsel aan Joe verduidelik. Verskaf die tekening wat dit verduidelik aan haar.
1.3 Create a context diagram of the proposed system, *using the interview presented in Appendix A*. Make assumptions where necessary.	9	1.3 Teken 'n konteksdiagram van die voorgestelde stelsel, *deur van die onderhoud in Bylae A gebruik te maak*. Maak aannames waar nodig.

QUESTION / VRAAG 2 [PROJECT MANAGEMENT | PROJEKBESTUUR] [15]

2.1 Draw an expectations management matrix for this system to support Kira in managing the users' expectations.	5	2.1 Teken 'n verwagtingsbestuurmatriks vir hierdie stelsel om Kira te ondersteun wanneer sy die gebruikers se verwagtinge bestuur.
2.2 Kira struggle with some aspects regarding project management. Your help is needed with the following:		2.2 Kira sukkel met sommige aspekte rondom projekbestuur. Jou hulp word benodig met betrekking tot die volgende:
2.2.1 What is the difference between a summary task and a primitive task?	2	2.2.1 Wat is die verskil tussen 'n opsommende taak en 'n primitiewe taak?
2.2.2 What is the meaning of elapsed time? Can you supply an example?	3	2.2.2 Wat is die betekenis van verloopte tyd? Kan jy 'n voorbeeld gee?
2.2.3 How should Kira calculate the most likely duration of a task? Explain in full.	4	2.2.3 Hoe moet Kira die mees waarskynlike duur van 'n taak bereken? Verduidelik volledig.
2.2.4 Name two techniques that Kira can use to help her estimate task durations.	1	2.2.4 Noem twee tegnieke wat Kira kan gebruik om haar te help met die skatting van taakduurtes.

Question | Vraag 3 [FACT-FINDING | FEIT-INSAMELING] (18)

3.1 Use the interview guidelines you studied to criticize the interview that Kira conducted with Jack. Only focus on the aspects that is clear from the interview supplied in Appendix A (e.g. you will not comment on Kira's attire, because you have no indication regarding what she wore to the interview).	8	3.1 Gebruik die onderhoudsriglyne wat jy bestudeer het om die onderhoud wat Kira met Jack gehad het, te kritiseer. Fokus slegs op die aspekte wat duidelik is uit die onderhoud verskaf in Bylae A (so sal jy nie kommentaar lewer op Kira se kleredrag nie, want jy weet nie wat sy gedra het tydens die onderhoud nie).
3.2 Study the list of requirements compiled by Kira. Choose one functional and one non-functional requirement to compile a requirements definition (e.g. Volere).	10	3.2 Bestudeer die lys van vereistes wat deur Kira saamgestel is. Kies een funksionele en een nie-funksionele vereiste om 'n vereiste definisie saam te stel (bv. Volere).

Number	Requirement	Classification
01	The system should allow employees to update their own information, including addresses, phone numbers, emergency contact information, beneficiary information, paycheck deductions, office location, office phone number, and office e-mail address.	Functional
02	The system should be accessible over the web and be secure.	Non-functional
03	The system must provide a searchable online company directory.	Functional
04	The system should provide a facility that makes it easy for employees to sign up and manage United Way deductions and other payroll deductions from their desk.	Functional
05	The system should provide managers with the tools to monitor United Way participation activity.	Functional
06	The system should provide ad-hoc query and reporting functionality.	Functional
07	The system should run on a system that is less expensive to operate than the mainframe.	Non-functional
08	The system should integrate all employee data databases into a single unified database.	Non-functional
09	A given employee's information (other than company directory information) should be accessible only by that employee, that employee's manager, and HR administrators.	Non-functional
10	The system should allow users to view the organization structure, meaning information about who an employee's manager is and other employees who report to the same manager.	Functional
11	The system should be easy to use, intuitive, and employ a graphical user interface.	Non-functional

Question | Vraag 4 [USE CASE MODELLING | GEBRUIKSGEVALMODELLERING] (14)

4.1 Explain the process of requirements use case modelling.	4	4.1 Verduidelik die proses van gebruiksgevalmodellering vir die vasstelling van vereistes.
4.2 Apply the steps you listed in question 4.1 to the case study. You may use the supplied Use-Case Glossary. You may omit step 4.	10	4.2 Pas die stappe wat jy in vraag 4.1 gelys het, op die gevallestudie toe. Jy mag die gebruiksgevalwoordelys gebruik. Jy mag star 4 uitlaat.

Use-Case Glossary

Use-Case Name	Use-Case Description	Participating Actors and Roles
Search Employee Directory	This use case describes the event of searching the employee directory.	Employee
Login	This is an abstract use case, which describes the login process.	
Update Employee Profile	This use case describes the event of updating the employee profile information.	Employee
Enter New Employee Profile	This use case describes the event of entering a new employee with name, job title, supervisor, emergency contacts, payroll deductions, and United Way contributions.	Staffing Dept
View United Way Participation	This use case describes the event of viewing United Way participation for all employees a manager directly supervises.	Manager
Update Employee Secure Data	This use case describes the event of updating pay rates, job title, and supervisor for employees.	Staffing Dept
Query via SQL	This use case describes the event of building an ad-hoc query with SQL	Manager
Perform Employee Detail Lookup	This use case describes the event of viewing a list of employees in any one department so that one can be selected for VIEW EMPLOYEE PROFILE.	Manager HR
Perform Employee Group Lookup	This use case describes the event of viewing a list of employees based on various selection conditions (job code, building, department, salary/wage range, home city, phone exchange, employment status, etc.) with the option of selecting one for VIEW EMPLOYEE PROFILE.	Manager HR
View Employee Profile	This is an abstract use case, which describes the event of viewing a complete profile for a single employee.	

Question | Vraag 5 [DATA & PROCESS MODELLING | DATA & PROSES MODELLERING] [22]

5.1 Apply the steps stated below to the case study. You may use the *business rules* supplied. *The printout of the **Employee Telephone Listing** may also be of help.*

12

5.1 Pas die stappe wat hieronder gelys is op die gevallestudie toe. Jy mag ook die *besigheidsreëls* wat aan jou verskaf is, toepas. Die drukstuk van die Werknemertelefoonlys mag jou ook help.

Steps to draw a detailed ERD:

1. Draw a Context Data model.
2. Draw a Key-based data model, add generalisation & specialisation.
3. Draw a Fully attributed data model.

The ERD should be based on the following assumptions and/or business rules:

- The Employee, SalaryEmployee, HourlyEmployee, and ContractEmployee entities compose a generalization hierarchy. Students may identify it here or only in the fully attributed data model. Each Employee works in a Department and a Department employs one or more Employees.
- Every Employee has zero or more EmergencyContacts.
- Site, Building, Room, and MailStop could be setup just as attributes in the Employee entity. However, by making them separate entities we can assure that spelling is consistent for all records and provide the user interface with dropdown controls to lookup the values.
- An Employee will make zero or more UnitedWayContributions (zero or one each year).
- An Employee will specify one or more MiscDeductions. Every hourly and salary employee must specify MiscDeductions at least once when they first hire in, and they can change them at any time. But contract employees do not have MiscDeduction records.

Detailed rules:

- The Employee entity includes EmpMiddlename, EmpNickname, and EmpHireDate.
- The EmpSup attribute in Employee is actually a foreign key to the EmpID of other records in Employee. This self-join is fairly advanced for students to detect and setup unless they have prior database design experience or were drilled on this kind of relationship. It is, however, the best and easiest way to implement employees and supervisors in a database.
- The entities that have concatenated primary keys and are also parent entities (MailStop and Room) must contribute both primary keys to child entities (Room and Employee) as foreign keys.
- In MiscDeduction, beginning data designers will be tempted to have fields for each of the various kinds of deductions. That is ultimately a bad idea because deductions will surely change over time. With a little thinking, attributes such as these can be devised that will work for essentially any kind of deduction.

5.2 Use the steps to do process modelling listed below to guide you to draw an event decomposition diagram. *The interview listed in appendix A may help you.*

10

5.2 Gebruik die stappe gelys om prosesmodellering te doen om jou te lei om 'n gebeurtenisafbreekdiagram te teken. *Die onderhoud in bylae A gelys mag jou help.*

Process modelling steps:

1. Draw context DFD
2. Draw functional decomposition diagram
3. Create event-response or use-case list
4. Add one process, called the event handler to the decomposition diagram
5. OPTIONALLY: Draw an event DFD (or event handler) for each event
6. Merge event DFDs into a system diagram (or, for larger systems, subsystem diagrams)
7. Draw detailed, primitive DFDs
8. Use Structured English & Decision Tables
9. Represent data structures

QUESTION / VRAAG 6 [FEASIBILITY ANALYSIS & THE SYSTEM PROPOSAL | UITVOERBAARHEIDSANALISE & DIE STELSELVOORSTEL] [12]

6.1 State the formula you will use to do return-on-investment analysis. 2

6.1 Verskaf die formule wat jy sal gebruik om opbrengs-op-belegging analise te doen.

6.2 For the system Kira is analysing and designing, three candidate solutions have been identified. Their estimated lifetime benefits and estimated lifetime costs are shown below. All have been time-adjusted over the projected five-year lifetime of each alternative. 7

6.2 Drie kandidaatoplossings is vir die stelsel wat Kira ontleed en ontwerp, geïdentifiseer. Hul geskatte lewensduur voordele en kostes word hieronder getoon. Almal is aangepas vir die tydsverloop van 'n geprojekteerde vyfjaar lewensduur van elke alternatief.

Solution	Estimated Lifetime Benefits	Estimated Lifetime Costs
Candidate Solution #1:	$640,000	$372,000
Candidate Solution #2:	$640,000	$360,000
Candidate Solution #3:	$640,000	$385,000

According to return-on-investment analysis, which candidate solution offers the highest ROI? If the company sets a minimum lifetime ROI of 80%, which of these solutions is/are economically feasible?

Show all calculations.

Volgens opbrengs-op-belegging analise, watter kandidaatoplossing bied die hoogste OOB? Indien die maatskappy 'n minimum lewensduur OOB van 80% stel, watter van die oplossings is ekonomies haalbaar?

Wys alle berekenings.

6.3 The percentages you obtained in question 6.2 are not annual percentages. State the formula to calculate the annual ROI percentages and calculate it for the three candidates. 3

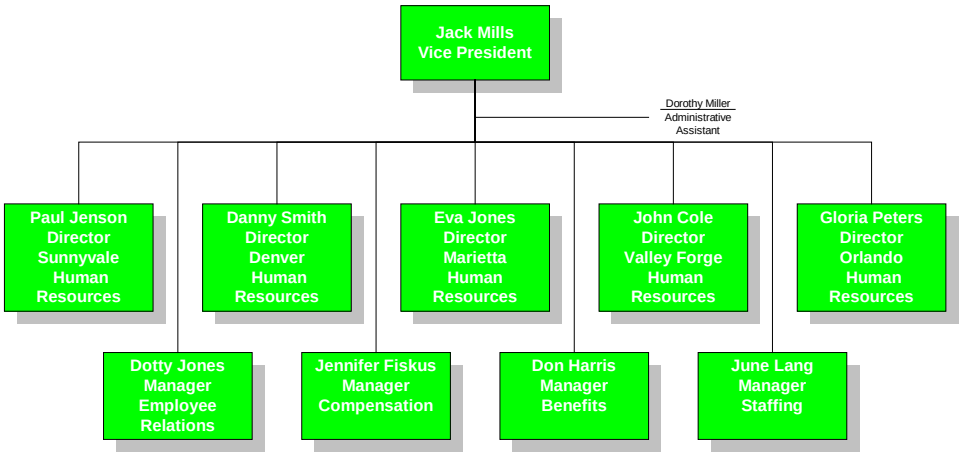
6.3 Die persentasies verkry uit vraag 6.2 is nie jaarlikse persentasies nie. Gee die formule om die jaarlikse OOB persentasies te bereken en doen die berekeninge vir die drie kandidate.

APPENDIX | BYLAE A

Scene: ***Kira Webster**, systems analyst, is meeting with **Jack Mills**, Vice President of Human Resources for A-1 Information Systems, at his office. Ms. Webster scheduled the interview with Mr. Mills in response to his request for developing a new system to house employee information.*

Jack:	Good Morning! You must be Kira Webster.
Kira:	Yes, I am sir. Are you Mr. Jack Mills?
Jack:	Yes. Please call me Jack. I'm glad we could get together today. Things are quite chaotic around here.
Kira:	What do you mean?
Jack:	Our executive steering committee is very anxious to set in motion our plan for reengineering and modernizing our systems and computing resources. The first phase of that plan concentrates on Human Resources, and that is why you are here.
Kira:	That's sounds like an enormous task, but I love challenges.
Jack:	It is monumental, but we tried to simplify the task by breaking it up into smaller pieces. The first piece deals with the **tracking and management of employee information**.
Kira:	What is your current system like?
Jack:	My Employee Relations manager, **Dotty Jones**, who by the way will be your key user contact, explained the process in detail to me yesterday. I don't interact with it myself, but it appears there are **a lot of inefficiencies and its operating costs are exorbitant**. The system itself is a **combination of manual and automated processes**.
Kira:	Will this system replace all the legacy systems?
Jack:	Not all of them initially. That is too big and risky of an effort.
Kira:	Could you please describe for me the **business processes** that will be included in the system?
Jack:	I think the best way to explain the process is to start from the beginning. The first day employees report to work they go through an orientation program. During that program they are required to complete some personnel forms that include information such as addresses, phone numbers, emergency contact information, and beneficiary information. They can also elect to have various things deducted from their pay checks, including United Way donations, parking, extra life insurance, and the pre-tax medical reimbursement plan. This data is then input into the legacy mainframe system by one of my administrators. This is a COBOL-based system using, in my opinion, obsolete database and file technology. I say that because every time another system needs employee data, we have to send them a sequential file sometimes daily, weekly, or monthly. So we have multiple copies of employee information throughout our systems, which may or may not be in sync.
Kira:	What do you mean by that?
Jack:	If employees need to change any of their personal information that we have on file, they must complete a form and submit it to us to be input into the system. Currently, it could be weeks before that change gets distributed across all the necessary systems. This is especially critical for payroll. People aren't very happy if they don't receive their checks on time because they have moved and the payroll system doesn't have their current address.
Kira:	I can understand that concern. You mentioned a micro application. Where does that come into play?
Jack:	Oh. **On a quarterly basis we produce and publish an employee telephone listing, sort of a company telephone book**, which consists of the employee's work telephone number and work location. This information resides on a microcomputer that is maintained by **Alice Cockran**, an administrator, who works for Dotty. Because we are such a dynamic and growing company, Alice spends 30 percent of her workweek maintaining the information. Each quarter we produce 5,000 copies of the book and distribute them across the company. Currently this process costs the company $27,000 a year. The sad thing is, the book is probably already out of date the day it is published.
Kira:	What do you mean?
Jack:	We are a large and growing company with sites all over the nation. Every day at least someone is hired or transferred, moves offices, or is terminated. These events all trigger a change to the listing.
Kira:	Before I forget to ask, may I have a copy of your organization chart and who of your organization besides Dotty will be working with me on this project?
Jack:	Good questions. I will have my secretary send you a copy of my organization chart [***the organization chart appears following the interview***]. Like I said before, Dotty Jones will be your direct contact. Her phone is 838-1040 and she sits in office 1016. But, I don't have a problem with you talking to anyone in the HR department if it will help you. By the way my phone number is 838-4456. For now I have a copy of part of a page from our Employee Telephone Listing for you [***the Employee Telephone Listing page appears following the interview***]**.** Dotty will supply you with more forms.
Kira:	Thank you. For this project to be a success we must work as a team and you, the user, certainly must be involved. Now let's talk about the technology you are currently using. Does everyone use a PC?
Jack:	Yes we do. We supposedly have the latest and greatest personal computers that come with the standard word processor, spread sheet, and database. If you need detailed configuration information, I'm sure Dotty can provide that to you.
Kira:	Do you have electronic mail and do you use the Internet?
Jack:	We are heavy E-mail users.
Kira:	I have just a few more questions so hopefully we won't be much longer. What is your vision of the new system?
Jack:	I envision a system that is easy to use, intuitive, with a graphical user interface. It should be accessible from every desktop in the company (and, as I said, from home using the Internet, provided that it is extremely secure). The interface should be consistent no matter what platform you are using. I have long had the idea that the interface should have a folder metaphor. In other words, if you were an employee entering the system, you would be presented with a series of folders or tabs. Each folder would consist of a certain type of information, such as emergency information, beneficiary information, deductions, and in the future benefits, training, and so on.
Kira:	That's a good vision.
Jack:	And one last thing, which should be held in the utmost confidence. By the end of the year I need to reduce my organization by five administrative positions because of pending overhead reductions. The only way that is remotely feasible is if this system achieves the goal of allowing employees to maintain their own information online. I hope this stresses to you the importance of this project.
Kira:	By all means it does. This has been a very informative and productive meeting. I'm going to review this information and give you my report early next week. Thank you for your time today, Mr. Mills.

A-1 Information Systems
Human Resources



A-1 Information Systems

Employee Telephone Listing

Rev. Date: 01/15/2006

Name	Emp. No.	Dept.	Office Phone	Site	Bldg	Room	Mail Stop
Jacobs, John C	77423	6410	(407) 306-1159	ORL	E7	2234	359
James, Teresa, L	76452	6420	(407) 306-1223	ORL	E8	2467	358
Jansen, Becky E	73221	6500	(770) 595-6722	MAR	22	1190	A12
Jeffries, Lora L	77667	6540	(770) 595-6788	APR	23	1170	A12
Jenkins, Tom A	78521	7200	(215) 393-2288	VF	AA	98	69
Johnson, Gus L	79451	5210	(408) 743-8516	SUN	X.2	98	MA