

An Inventory and a Taxonomy of Skills for Entry-level IT Employees
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DISCIPLINE DEPENDENT SKILLS			
I.	IT management		
#	Short title	Description	
1	Big Data analysis & decision support(BI)	Ability to design and create a data warehouse and to use its contents in order to support strategic decision making. (Should I add a Data Collection skill to account for Internet of Things or include IoT as part of Infrastructure design?)	
	1 Dimensional databases	1	Ability to explain the differences between a relational and a dimensional database.
	2 Data warehouses	2	Ability to create a dimensional database to implement a data warehouse to support decision making.
	3 Data extraction and cleanup (ETL)	3	Ability to use tools and techniques to extract data from diferent sources and to improve data quality.
	4 Data transformation and load (ETL)	4	Ability to use tools and techniques to perform data transformation and to populate a dimensional database.
	5 User interface for decision support	5	Ability to create a user interface to allow management to access and analyze data to support decision making.
2	IT governance	Ability to identify, explain and analyze aspects regarding data center administration, like location, organizational structure, functions, resources, etc.	
	6 Data Center functions	6	Ability to identify typical data center functions.
	7 Data Center location	7	Ability to identify usual locations for data centers in organizations.
	8 Data Center organization	8	Ability to identify typical organizational structures for data centers in organizations.
	9 Centralization vs decentralization	9	Ability to evaluate the advantages and disadvantages of centralized versus decentralized data center operations.
	10 Human resources & career paths	10	Ability to identify the positions and career paths usually found in a data center.
	11 Cloud computing	11	Ability to analyze major considerations of using cloud computing to procure data center services, like IaaS, PaaS, and SaaS.
	12 Outsourcing	12	Ability to analyze major considerations related to outsourcing data center operations.
	13 Negotiation and procurement of IS/IT resources	13	Ability to explain the process and considerations to negotiate and procure IS/IT resources and services for the organization.
	14 IT control and governance frameworks	14	Ability to explain the role of IT control and governance frameworks (COBIT, ITIL, etc.) in managing the organizational IT infrastructure.
3	Regulatory, control and security framework	Ability to explain and analyze regulatory, control and security framework of information systems. Also includes the ability to implement some control and security measures.	
	15 Risk identification	15	Ability to identify risks associated to the IS function in an organization. (May include the use of risk assessment frameworks, like COSO and COBIT.)
	16 Risk assessment	16	Ability to evaluate the probability of the occurrence of risks, as well as their impact. (May include the use of risk assessment frameworks, like COSO and COBIT.)
	17 IS controls	17	Ability to identify controls that can reduce the probability of risk occurrence.
	18 Assessment of existing controls	18	Ability to evaluate the effectiveness of existing controls to detect and avoid risks.
	19 Recovery measures	19	Ability to identify measures to recover IS/IT operations when interrupted.
	20 Disaster recover plans	20	Ability to prepare a disaster recovery plan, consisting of the identification and evaluation of risks, the identification and evaluation of controls to avoid those risks, and the identification of meassures to recover from interruptions.
	21 Regulatory environment	21	Ability to analyze the impact of the regulatory enviroment upon the IS field and IS professionals.
	22 Application controls	22	Ability to identify, design and implement application controls in the design and implementation of systems.
	23 General controls	23	Ability to identify and design general controls, particularly in the design and implementation of technological infrastructure.
4	Project management	Ability to create a plan to implement an IS project and to control the execution of the plan.	
	24 Project selection	24	Ability to analyze the suitability of several projects to be implemented.
	25 Scope management	25	Ability to identify the tasks that form the scope of a project, as well as their dependencies.
	26 Time and cost management	26	Ability to prepare time and cost estimates for the tasks that compose the scope of a project.
	27 Communications management	27	Ability to identify means for keeping stakeholders informed about all aspects of the project.
	28 Risk management	28	Ability to identify risks related to a project, and to evaluate the probability and impact of each one of them.
	29 Quality management	29	Ability to identify quality measures for the deliverables, as well as the processess, of a project.
	30 Human resources management	30	Ability to identify the human resources necessary to perform the tasks in a project.
	31 Procurement management	31	Ability to analyze when to use vendors to procure project resources, to negotiate procurements and to control the performance of these vendors in the project.
	32 Stakeholder management	32	Ability to identify and involve all people with interest in the project, and to evaluate and take care of their needs and expectations.
	33 Integration management	33	Ability to integrate all tasks involved in a project into a comprehensive project plan.
	34 Project management tools	34	Ability to use a project management tool to prepare and control the project plan.

35	Resistance to change	35	Ability to identify the factors that provoke resistance to change and ways to deal with them.
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II. Analysis & logical design			
#	Short title	Description	
5	Business process analysis	Ability to collect, organize and analyze data from an operation in order to understand it and to support the design of a new way to perform it.	
36	Data collection	36	Ability to collect data about current operations through several approaches (interviews, observation, etc.).
37	Data organization	37	Ability to organize data through several techniques (narratives, tables, diagrams, etc.)
38	Problem identification	38	Ability to identify problems in the operation being analyzed.
39	Opportunity identification	39	Ability to identify opportunities not being taken care of through current operations.
6	Business process modeling /design	Ability to design a new way to perform an operation in order to avoid current problems and to take advantage of opportunities.	
40	Process diagramming techniques	40	Ability to apply process diagramming techniques when documenting processes.
41	Process diagramming tools	41	Ability to use process diagramming tools when documenting processes.
42	Domain specific knowledge	42	Ability to apply basic rules related to the particular business domain being redesigned.
7	Requirements definition	Ability to determine, and document through system requirements, the functionality that a system must provide in order to make it suitable to support an operation.	
43	Types of requirements	43	Ability to identify different type of requirements, with emphasis on functional requirements.
44	New way to operate	44	Ability to integrate a group of requirements into a new way to perform an operation.
45	Requirements report	45	Ability to integrate system requirements into a meaningful report which can be used to design a new system or to procure one.

III. Enterprise systems			
#	Short title	Description	
8	Enterprise Resource Planning (ERP)	Ability to explain how ERP systems work and to use these systems to perform basic organizational processes.	
46	Main characteristics	46	Ability to mention the main characteristics of ERP systems.
47	Functionality provided	47	Ability to explain the functionality provided by ERP systems.
48	ERP organizational processes	48	Ability to use an ERP system to perform basic organizational processes.
9	Customer Relationship Management (CRM)	Ability to explain how CRM systems work and to use these systems to perform basic organizational processes.	
49	Main characteristics	49	Ability to mention the main characteristics of CRM systems.
50	Functionality provided	50	Ability to explain the functionality provided by CRM systems.
51	CRM organizational processes	51	Ability to use a CRM system to perform basic organizational processes.
10	E-Business	Ability to explain how E-Business systems work and to use these systems to perform basic organizational processes.	
52	Main characteristics	52	Ability to mention the main characteristics of E-Business systems.
53	Functionality provided	53	Ability to explain the functionality provided by E-Business systems.
54	E-Business organizational processes	54	Ability to use an E-Business system to perform basic organizational processes.
11	Web Content Management Systems (WCMS)	Ability to explain how WCMS work and to use these systems to create web sites.	
55	Main characteristics	55	Ability to mention the main characteristics of WCMS.
56	Functionality provided	56	Ability to explain the functionality provided by WCMS.
57	Web site creation	57	Ability to use a WCMS to create a web site for an organization.

IV. Implementation			
#	Short title	Description	
12	Systems procurement (Sourcing)	Ability to evaluate system alternatives based on system requirements, and to recommend one of the alternatives. It includes all kinds of systems, both internally developed or purchased (ERPs, CRMs, SCMs, Ebusiness, etc.). (It could be renamed "Systems sourcing".)	
58	Evaluation criteria	58	Ability to determine the criteria to be used in the evaluation of proposals.
59	Procurement conditions	59	Ability to determine special conditions related to the acquisition of the system.
60	RFP preparation	60	Ability to integrate system requirements and procurement conditions into a Request for proposals (RFP).
61	Proposal evaluation	61	Ability to evaluate proposals by scoring each one of them based on the evaluation criteria.

	62	Contract negotiation	62	Ability to identify and negotiate main clauses to be included in the contract to procure a system.
13	Systems deployment		Ability to perform the tasks involved in the implementation of a system, so as to make it ready to start a live operation. Includes all kinds of systems (ERPs, CRMs, SCMs, Ebusiness, etc.), both internally developed or purchased.	
	63	Systems configuration	63	Ability to create and enter the configuration parameters necessary for a system to function properly, like account numbers, late payment charges, interest rates, etc.
	64	Integration testing	64	Ability to create comprehensive testing cases, perform the corresponding tests, evaluate and document results, control the modifications, etc.
	65	Data conversion	65	Ability to perform and control data conversion tasks, like file exporting/importing, data cleanup, and data collection/data entry control.
	66	Procedure design	66	Ability to prepare procedures to document transaction flow and processing.
	67	User training	67	Ability to design, create and perform trainings on how to use a new system.

V. Physical design				
#	Short title		Description	
14	Physical systems design		Ability to physically design system components like the database, screens/pages, reports, and the programs to implement the business rules. It also includes documentation for each component, as well as for the whole system.	
	68	Database design	68	Ability to design a normalized database to support applications. (Database processing and database administration are included under other categories.)
	69	Screen or web page design	69	Ability to design screens or web pages to enter data and to display results.
	70	Report design	70	Ability to design generic reports (instead of special forms).
	71	Form design	71	Ability to design special forms, like invoices, checks, dunning notices, account statements, etc.
	72	Process design	72	Ability to design batch and/or interactive processes to implement process-related business rules.
	73	Design documentation	73	Ability to document the individual system components and to integrate these documents into a full system documentation.
15	Infrastructure design		Ability to design LANs, WANs, SANs, server farms, etc., to support the operation of a system. Includes design documentation and basic software installation. (It does not include hardware or cabling installation tasks. Cloud computing is included under IT Governance.)	
	74	LAN components	74	Ability to identify the components of a LAN and to specify the main characteristics of these components.
	75	LAN design	75	Ability to integrate all LAN components into a full LAN design, in order to support the operation of an application.
	76	WAN components	76	Ability to identify the components of a WAN and to specify the main characteristics of these components.
	77	WAN design	77	Ability to integrate all WAN components into a full WAN design, in order to support the operation of an application.
	78	SAN components	78	Ability to identify the components of a SAN and to specify the main characteristics of these components.
	79	SAN design	79	Ability to integrate all SAN components into a full SAN design, in order to support the operation of an application.
	80	Server farm components	80	Ability to identify the components of a server farm and the main characteristics of these components.
	81	Server farm design	81	Ability to integrate all server farm components into a full server farm design, in order to support the operation of an application.
	82	Specialized I/O devices	82	Ability to identify special I/O devices, like IoT devices, and to integrate them into an infrastructure design.
	83	Resource virtualization	83	Ability to describe the benefits of virtualizing resources like servers and stations.
	84	Design documentation	84	Ability to document the infrastructure design using a network diagramming tool.
	85	Regulations, standards & codes	85	Ability to apply regulations, standards, and codes when designing infrastructure. For example, electrical codes, firemen codes, IEEE standards, etc.

VI. Programming				
#	Short title		Description	
16	Programming system components		Ability to create and integrate main systems components, like databases, screens, reports, forms, procedures, and services, using a development tool. (Unit testing is included under Programming Fundamentals.) (Equivalent to "Intermediate programming")	
	86	Database creation and processing	86	Ability to create a normalized database, and to process it, using SQL statements. (Database design and database administration are included under other skill sets.)
	87	Screen design and creation	87	Ability to create screens to enter and display database contents.
	88	Report design and creation	88	Ability to create reports about database contents.
	89	Interactive database processing	89	Ability to create interactive dialogs to add, delete, modify, and query database contents using procedural tools.
	90	Batch processes	90	Ability to create programs or procedures to process groups of records.
	91	Component documentation	91	Ability to document a program, both internally (through remarks, standards and significant names) and externally (through a written document).
	92	Advanced code structuring and sharing	92	Ability to structure and share code through more advanced techniques, like classes, APIs, triggers or stored procs.

17	Web and mobile programming	Ability to create new programs using web and mobile development tools. (Unit testing and program documentation is included under Programming Fundamentals.)	
	93 Server interactions	93	Ability to minimize server interactions when validating and processing data, so as to reduce server overload.
	94 Web page design	94	Ability to design and create web pages using HTML, tables, cascading style sheets (CSS), and web-server controls.
	95 State management	95	Ability to preserve the status of a program between page postbacks.
	96 Web services (Service Oriented Architecture)	96	Ability to describe the function of web services to support the interoperability between application components in a network.
	97 Mobile applications	97	Ability to create basic mobile applications.
18	Programming fundamentals	Ability to create new programs, and to modify existing programs, using object-oriented, visual tools. (Includes unit testing and program documentation.)	
	98 Steps in program development	98	Ability to perform all steps in program development, like problem definition, program design, program coding, program testing and program documentation.
	99 Basic programming constructs	99	Ability to declare and use variables/constants/arrays, and to perform basic operations, like input/output, arithmetic, loops, conditions, etc.
	100 Basic code structuring techniques	100	Ability to structure and share code through basic techniques like functions, and procedures.
	101 Basic file processing	101	Ability to create and process text or sequential files.
	102 Programming standards	102	Ability to use naming conventions, internal documentation, standard variable definitions and other organizational standards.
	103 Program testing	103	Ability to test a program and to document the test results. (It is really "Unit testing".)
	104 Basic program documentation	104	Ability to document a program internally (through remarks, standards and meaningful names). (External documentation through a written document is included elsewhere.)
	105 Program deployment /publishing	105	Ability to deploy or publish new or modified programs, together with their software infrastructure requirements.

VII. IT operations & maintenance			
#	Short title	Description	
19	Infrastructure operations & maintenance	Ability to perform basic operational and maintenance tasks on servers, stations, printers, and communications equipment.	
	106 Physical requirements	106	Ability to identify the physical, electrical and air conditioning requirements for properly operating a technological infrastructure.
	107 Physical controls	107	Ability to identify the most common physical controls related to the operation of an infrastructure (access control, smoke and fire detectors, humidity control, etc.).
	108 Warranty and service agreements	108	Ability to identify the different types of warranty and service agreements available to support infrastructure operations, as well as their main characteristics.
	109 Infrastructure operating procedures	109	Ability to explain the importance of following operating procedures when operating technological infrastructures.
	110 Basic operational tasks	110	Ability to perform basic operational tasks, like managing users, access rights, and devices, and performing basic troubleshooting.
	111 Software installation /reinstallation	111	Ability to install, reinstall and configure infrastructure related software, like the operating system, web services, device drivers, etc. (This skill may be moved to Infrastructure design.)
20	Applications maintenance	Ability to perform program fixes and minor application enhancements, and to control this process. (Testing and documentation of fixes is included under Programming Fundamentals or Programming System Components.)	
	112 Version & modification control	112	Ability to keep track of modifications performed to a program and to control its different versions. (Other Applications Maintenance related skills are included under Programming Fundamentals or Programming System Components.)
21	Database administration	Ability to explain how basic database administration functions work (like fine tuning/restructuring, security/backup/recovery, and concurrent access). (Database design is included under Physical systems design. Database creation and processing is included under Programming system components.)	
	113 Fine tuning and restructuring	113	Ability to identify strategies to improve database access and processing, like indices, alternate paths, caching, etc.
	114 Security, backup and recovery	114	Ability to identify different security, backup and recovery alternatives available for databases.
	115 Privacy	115	Ability to identify ways to control the access to a database.
	116 Concurrent access	116	Ability to analyze the implications of concurrent access to the database, as well as strategies to deal with it.
22	User support /CRM/URM	Ability to perform basic user support activities, mostly technical (i.e. computers, printers, Internet access, and office applications), but also regarding functional operations (i.e. industry and business rules). Includes some level of CRM (Customer relationship management) or URM (User relationship management).	
	117 Organization and functions of a Help Desk Unit	117	Ability to mention the functions performed by a Help desk unit and the way it should be organized.
	118 Call logging and documentation	118	Ability to record service calls received and to obtain details required to analyze and assign them.
	119 Help Desk statistics	119	Ability to identify and maintain basic Help desk statistics, like calls received, pending calls, calls per Help desk clerk, etc.
	120 User relations and communication	120	Ability to recognize the importance of maintaining good relations and communication with users.

121	Technical support tasks	121	Ability to perform basic technical support tasks.
122	Functional support tasks	122	Ability to perform basic functional support tasks.

DISCIPLINE INDEPENDENT SKILLS			
VIII. Personal skills			
#	Short title	Description	
23	Personal productivity skills	Ability to utilize personal productivity tools.	
123	Keyboarding	123	Ability to use a keyboard to execute applications and to enter data.
124	OS operations	124	Ability to perform basic operating system functions like copying, moving and deleting files, installing and executing applications, etc.
125	Word processing	125	Ability to prepare documents using a word processor.
126	Spreadsheets	126	Ability to prepare worksheets using a spreadsheet program.
127	Presentations	127	Ability to prepare presentations using a presentation program.
128	Internet	128	Ability to use the Internet to access data, download programs, and send/receive emails.
129	Social networking	129	Ability to use social networking tools to interact with other people, like customers, vendors and workmates.
24	Soft skills	Ability to interact effectively with coworkers and customers, and to pursue continuous development.	
130	Life-long learning	130	Ability to recognize the need to keep abreast and to continuously pursue professional development.
131	Ethical behavior	131	Ability to recognize the importance of ethical behavior in a computing professional.
132	Written/oral communication	132	Ability to communicate effectively with a range of audiences, both orally and written, in Spanish and English.
133	Teamwork	133	Ability to function effectively in teams seeking to accomplish a common goal. (Including virtual teams.)
25	Analytical/Problem solving skills	Ability to apply knowledge and skills to address unstructured situations. (Although these skills are part of most other skills.)	
134	Analysis	134	Ability to decompose an unstructured situation into its key components and to identify relationships among these components.
135	Synthesis	135	Ability to integrate individual components into a meaningful and structured whole.
136	Application	136	Ability to apply applicable knowledge and skills into the analysis and synthesis of an unstructured situation.

IX. Entrepreneurship (This skill category could be eliminated as a separate skill category and included as a skill set under the Personal skills category.??)			
#	Short title	Description	
26	Entrepreneurship	Ability to evaluate the feasibility of a computing business idea and to prepare a plan to implement it.	
137	Feasibility study	137	Ability to evaluate the feasibility of a computing-related business idea.
138	Business plan	138	Ability to prepare a plan to implement a computing-related business idea.
139	Business organization	139	Ability to describe ways in which a business can be organized, and the accounting, reporting and regulatory framework applicable.

X. Industry skills			
#	Short title	Description	
27	Industry processes & regulations	Ability to describe processes, best practices and regulations related to all industries or to a particular one.	
140	Industry-independent processes	140	Ability to describe processes and best practices common to all industries, like Payroll, Inventory, Accounts receivable, Accounts payable, etc.
141	Industry-dependent processes	141	Ability to describe processes and best practices pertaining to a particular industry, like Banking, Distribution, Manufacturing, etc.
142	Industry regulations	142	Ability to describe regulations applicable to a particular industry, like Banking, Distribution, Manufacturing, etc.

Verbs used to express the four cognitive levels used in describing the different skills	
1	UNDERSTANDING (DEFINE/IDENTIFY/EXPLAIN/RECOGNIZE/BE AWARE OF/SPECIFY/DESCRIBE/CONSIDER/COMMUNICATE)
2	PERFORMING (IMPLEMENT/PERFORM/INSTALL/USE/DEPLOY/DOCUMENT/ORGANIZE/CONFIGURE)
3	ANALYZING (ANALYZE/EVALUATE)
4	CREATING (DETERMINE/DEVELOP/DESIGN/CREATE/INTEGRATE/APPLY)