ComparE

Design Document

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Overview

The *ComparE* system is a database system that enables users to compare electronic products such as computer and mobile. With a web interface, it runs on the network and can be used in two circumstances. For users with the desired product, it can compare various suppliers' prices of the item. Additionally, if users have not made a decision, entering the requirements and the system will show satisfied items. It also provides mechanism like password protection and privilege setting to secure personal information and copyright. Moreover, administrators will daily update its information to ensure users get the latest message on electronics. The system, therefore, facilitates comparison and selection of electronic products for customers.

Data Dictionary

The table of data dictionary

The data dictionary is built up throughout the logical design phase of the system, and it contains all information of the data to be used in the system.

Table 1 The table of data dictionary

ENTITY	DESCRIPTION	ALIASES	OCCURRENCE
Staff	General term describing all staff employed by *ComparE*	Employee	Each member of staff works at a particular position.
Supplier	Companies which supplies information about computer or mobile	Provider	Each supplier is able to supply one or more product.
Member	Person who registers an account in *ComparE* website	Membership	Each member has only one account.
Product *(Modified)*	Entities for comparing	Product	Each product has one or more purchase link.
Computer	One of products	Computer	Each computer belongs to product.
Mobile	One of products	Mobile Phone	Each mobile belongs to product.
Comment *(Modified)*	Comment of product which is given by a member	Product comment	Each product comment is only for one product.
PurchaseLink*(Modified)*	Purchase link to a particular product's supplier	Shopping site for that particular product	Each product's purchase link is corresponding to one supplier.
Feedback	Feedback from member which is used for technical improvement of *ComparE*	Outcome	Each feedback is written by one member.
SupplierTelephone	Telephone of supplier	Supplier's telephone	Each supplier has one telephone

		phone number	number for contact.
StaffPhone	Telephone of staff	Staff's phone number	Each staff has one phone number for contact.
Web	Web page contains many areas	Net	Each web page is built to support the usage of members, suppliers and staff.
ZipcodeAddress *(Modified)*	Address for member	Member's physical location excluding room or house number	Each zip code is used by one member.

Data dictionary showing description of relationships

Table 2 The table of descriptions of relationships

ENTITY	MULIPLICITY	RELATIONSHIP	MULTIPLICITY	ENTITY
Staff	1..*	Administrates	0..1	Web
	0..1	Supervises	0..*	Staff
	0..1	Responds	0..*	Feedback
StaffPhone	1..*	IsUsedBy	1..1	Staff
Web	1..1	Has	0..*	Member
	1..1	Has	1..*	Staff
	1..1	Compares	1..*	Product
Product	1..1	Has	1..*	PurchaseLink
Computer	1..1	BelongsTo	1..1	Product
Mobile	1..1	BelongsTo	1..1	Product
Member	1..1	Writes	0..*	Comment
	1..1	Writes	0..*	Feedback
	1..1	Registers	1..1	Web
ZipcodeAddress	1..2	IsUsedBy	1..*	Member
Supplier	1..*	Supplies	1..*	Product
SupplierTelephone	1..*	IsUsedBy	1..1	Supplier
Comment	0..*	IsFor	1..1	Product

Table 3 Column Header Description of data dictionary showing descriptions of attributes

ENTITY	Name of table
ATTRIBUTES	Column name (attribute name)
DESCRIPTION	Column name description
DATA_TYPE	Integer (1,2,3,4…), enumerated integer (integers are coded for non-integer meaning, see CODE_MEANINGS), decimal (0.5,2.5,…), string (reporter, doctor, lawyer…)
UNITS	Unit of variable if applicable, otherwise leave blank

MIN	Logical minimum value of variable if applicable
MAX	Logical maximum value of variable if applicable
NULLS	Boolean value that specifies whether nulls are allowed in this column**.** (Yes or No)
MULTI-VALUED	Boolean value that specifies whether the value can be multiple. (Yes or No)
KEY	Foreign key or primary key in that entity (Primary Key or Foreign Key or Primary Key, Foreign Key)
ALIASES	Alternative name
OCCURRENCE	Describe the situation when it happens
MULTIPLICITY	The number of occurrences of one entity that may relate to a single occurrence of associated entity.
RELATIONSHIP	The relationship between two entities

Data dictionary showing description of attributes with primary and alternate key

Table 4 The table of descriptions of attributes one

ENTITY	ATTRIBUTES	DESCRIPTION	DATA_TYPE
Staff	staffid	Staff's ID number	integer
	fname	Staff's first name	variable characters
	lname	Staff's last name	variable characters
	password	Password is used to log in	fixed characters
	securityquestion	Supplier input a security question avoiding forgetting password.	variable characters
	securityquestionanswer	The security question answer corresponds to security question.	variable characters
	position	Staff's work position, for example manager, worker and so on	variable characters
	salary	Staff's salary per month	float
	supervisorStaffid	Supervisor's ID number	integer
	address	Staff's physical address	variable characters
	e-mail	Staff's e-mail address	variable characters
	gender *(Modified)*	Staff’s gender	variable characters
Supplier	supplierid	Supplier's ID number	integer
	supplierName	Supplier's name	variable characters
	password	Password is used to log in	fixed characters
	address	Supplier’s physical address	variable characters
	e-mail	Supplier’s e-mail address	variable characters

	securityquestion	Supplier input a security question avoiding forgetting password.	variable characters
	securityquestionanswer	The security question answer corresponds to security question.	variable characters
	rating	The rating for supplier. There are five levels.	float
	logo *(Modified)*	Supplier's logo picture	variable characters
Member	memberid	Member's ID number	integer
	password	Password is used to log in	fixed characters
	fName	Member's first name	variable characters
	lName	Member's last name	variable characters
	gender	Male or Female	variable characters
	roomORhouseno	The number of member's room or house number	variable characters
	dateofbirth	Member's birthday (day/month/year)	date
	e-mail	Member's e-mail address	variable characters
	phoneno	Member's phone number	variable characters
	telno	Member's telephone number	fixed characters
	registerdate	Registration date (day/month/year)	date
	securityquestion	Member input a security question for the case of forgetting password.	variable characters
	securityquestionAnswer	The security question answer corresponds to security question.	variable characters
	dateoflastlogin	Last login date (day/month/year)	date
Product *(Modified)*	productid	Product's ID number	variable characters
	producttype	Type of product (computer or mobile)	Integer
	releasedate	Release date	date
	picture	Picture of product	variable characters
Computer	Productid	Computer's ID number	variable characters
	processor	The type of processor	variable characters
	memory	The size of main memory	integer
	storage	The size of hard drive	integer
	screensize	Computer's screen size	float
	type	The type of computer, for example, laptop and so on.	variable characters
	operatingsystem	Computer's operating system, for example, Windows, Mac and so on.	variable characters
	displaycard	The type of display card	variable characters
	weight	Computer's physical weight	float
	other	Other useful information	text
	rating	The rating for computer. There are five levels.	float
	viewtimes	The total number of view by members	binint
	brand *(Modified)*	The brand name of computer	variable characters
	picture *(Modified)*	The picture of this computer	variable characters

	color *(Modified)*	The color of this computer	variable characters
	minprice *(Modified)*	The minimal price which is supplier by suppliers	float
Mobile	productid	Mobile's ID number	variable characters
	platform	Platform of mobile, for example	variable characters
	connectivity	Type of connection, for example Bluetooth, USB and so on.	variable characters
	physicalsize	Physical size of mobile, length*width	float
	weight	Mobile's physical weight	float
	screensize	Mobile's screen size	float
	pixel	Mega Pixel Camera Phone	float
	battery	Battery behaviors	variable characters
	softwareapplication	Supported software applications	variable characters
	memory	Internal memory of mobile	integer
	externalmemory	External memory of mobile	integer
	other	Other useful information	text
	rating	The rating for mobile. There are five levels.	float
	brand*(Modified)*	The brand name of computer	variable characters
	picture*(Modified)*	The picture of this computer	variable characters
	color*(Modified)*	The color of this computer	variable characters
	mimprice*(Modified)*	The minimal price which is supplier by suppliers	float
	viewTimes	The total number of view by members	binint
Comment *(Modified)*	commentid	Comment number for a particular product	integer
	memberid	Member's ID number	integer
	productid	Product's ID number	variable characters
	content	Content of comment	text
	time	The time when leave comment	DATETIME
PurchaseLink *(Modified)*	productid	Computer's ID number	variable characters
	supplierid	Supplier's ID number	integer
	price	Provided price by supplier for this computer	float
	stock	In stock or not(Yes or No)	variable characters
	link	Purchase link to supplier	variable characters
Feedback	feedbackid	Feedback's ID number	integer
	memberid	Member's ID number	variable characters
	staffid	Staff's ID number	integer
	content	Content of feedback from member	text
	response	Content of response from staff	text
	writetime*(Modified)*	The time when member leave feedback	DATETIME
	title*(Modified)*	Feedback's title	variable characters
	responsetime*(Modified)*	The time when staff leave response for feedback	DATETIME
SupplierTelephone	telno	Supplier's telephone number	fixed characters
	Supplierid	Supplier's ID number	integer
StaffPhone	phoneno	Staff's phone number	Variable characters
	staffid	Staff's ID number	integer

Web	webname	Name of web	variable characters
	ipaddress	IP address for the website	variable characters
ZipcodeAddress *(Modified)*	zipcode	Zipcode corresponds to the address	variable characters
	nation	Nation corresponds to zipcode	variable characters
	country	Country corresponds to zipcode	variable characters
	city	City corresponds to zipcode	variable characters
	street	Street corresponds to zipcode	variable characters

Table 5 The table of descriptions of attributes and key two

ENTITY	ATTRIBUTES	UNITS	MAX	NULLS	MULTI VALUED	KEY
Staff	staffeid		10	No	No	Primary key
	fname		15	No	No	
	lname		15	No	No	
	password		40	No	No	
	securityquestion		40	No	No	
	securityquestionanswer		40	No	No	
	position		15	No	No	
	salary	Pound	6	No	No	
	supervisorstaffid		10	No	No	Foreign key
	address		35	No	No	
	e-mail		100	No	No	Alternate Key
	gender		6	No	No	
Supplier	supplierid		10	No	No	Primary key
	suppliername		15	No	No	
	password		40	No	No	
	address		100	No	No	
	e-mail		35	No	No	Alternate Key
	securityquestion		40	No	No	
	securityquestionanswer		20	No	No	
	rating	Star	10	No	No	
	logo		100	No	No	
Member	memberid		10	No	No	Primary key
	password		40	No	No	
	fname		15	No	No	
	lname		15	No	No	
	gender		6	Yes	No	
	zipcode		12	NO	NO	
	roomORhouseno		5	No	No	
	dateofbirth		-	Yes	No	
	e-mail		35	No	No	Alternate Key
	phoneno		13	Yes	No	
	telno		11	Yes	No	

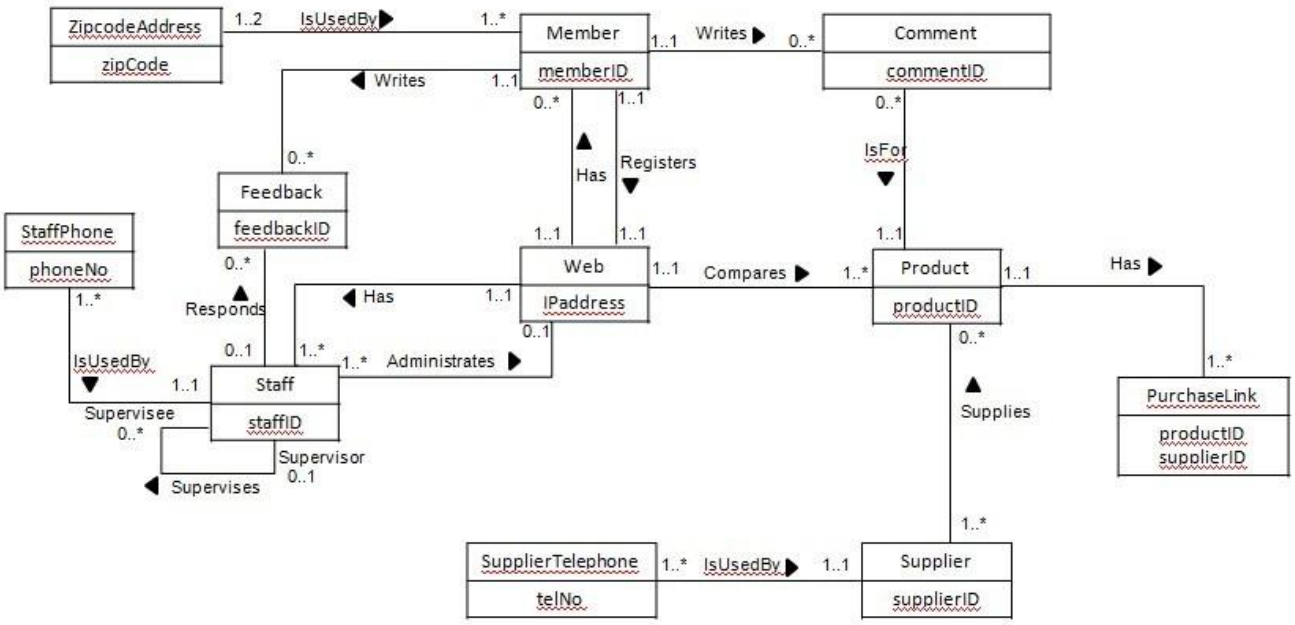
	registerdate		-	No	No	
	securityquestion		40	No	No	
	securityquestionanswer		20	No	No	
	dateoflastlogin		-	No	No	
Product *(Modified)*	productid		100	No	No	Primary key
	producttype		10	No	No	
	releasedate		-	No	No	
	picture		100	No	No	
Computer	computerid		100	No	No	Primary key
	processor		25	No	No	
	memory	GB	11	No	No	
	storage	GB	11	No	No	
	screensize	Inch	4	Yes	No	
	type		18	Yes	No	
	operatingsystem		10	No	No	
	displaycard		30	Yes	No	
	weight	Kg	8	Yes	No	
	other		-	Yes	No	
	rating	Star	10	No	No	
	viewtimes		20	No	No	
	color		50	No	No	
	brand		15	No	No	
	picture		100	No	No	
	minprice	pound	8	No	No	
Mobile	mobileid		100	No	No	Primary key
	platform		15	No	No	
	connectivity		300	No	No	
	physicalsize		25	No	No	
	weight	g	8	Yes	No	
	screensize	inch	4	No	No	
	pixel	Pix	7	No	No	
	battery		200	No	No	
	softwareapplication		200	No	No	
	memory	MB	11	No	No	
	externalmemory	GB	11	Yes	No	
	other		-	No	No	
	rating	Star	10	No	No	
	viewtimes		20	No	No	
	color		50	No	No	
	brand		15	No	No	
	picture		50	No	No	
	minprice	Pound	8	No	No	
Comment	commentid		10	No	No	Primary key

(Modified)	memberid		10	No	No	Foreign key
	productid		100	No	No	Foreign key
	content		-	No	No	
	time		-	No	No	
PurchaseLink *(Modified)*	productid		100	No	No	Primary key, Foreign key
	supplierid		10	No	No	Primary key, Foreign key
	price	Pound	8	No	No	
	stock		3	No	No	
	link		500	No	No	Alternate key
Feedback	feedbackid		10	No	No	Primary key
	title		30	Yes	No	
	memberid		10	No	No	Foreign key
	staffid		10	No	No	Foreign key
	content		-	No	No	
	response		-	Yes	No	
	writetime		-	No	No	
	responsetime		-	Yes	No	
SupplierTelephone	telno		11	No	No	Primary key
	supplierid		10	No	No	Foreign key
StaffPhone	phoneno		13	No	No	Primary key
	staffid		10	No	No	Foreign key
Web	webname		16	No	No	
	ipaddress		20	No	No	Primary key
Zipcodeaddress *(Modified)*	zipcode		12	No	No	Primary key
	nation		50	No	No	
	country		50	No	No	
	city		20	No	No	
	street		30	No	No	

Global Logical Data Model (ER Diagram)

The local data model is produced as an ER diagram for user views, thus these are brought together into a global data model.

Figure 1 The ER diagram of the system *(Modified)*



Logical Table Structures

Table 6 The table for the global logical data model *(Modified)*

Staff (staffID, fName, lName, password, securityQuestion, securityQuestionAnswer, supervisorStaffID, position, salary, e-mail, address, gender) **Alternate Key** e-mail **Primary Key** staffID **Foreign Key** supervisorStaffID **references** Staff(staffID)	**Supplier** (supplierID, supplierName, password, address, e-mail, securityQuestion, securityQuestionAnswer, rating, logo) **Alternate Key** e-mail **Primary Key** supplierID
Member (memberID, password, fName, lName, gender, zipCode, roomNo/houseNo, dateOfBirth, e-mail, phoneNo, telNo, registerDate, securityQuestion, securityQuestionAnswer, dateOfLatestLogin) **Alternate Key** e-mail **Primary Key** memberID	**Feedback** (feedbackID, title, memberID, staffID, content, wirteTime, response,responseTime) **Primary Key** feedbackID **Foreign Key** memberID **references** Member(memberID) **Foreign Key** staffID **references** Staff(staffID)
Product (productID, productType, releaseDate, picture) **Primary Key** productID	**Web** (webName, IPaddress) **Primary Key** IPaddress
Computer (productID, processor, memory, storage, screenSize, type, operatingSystem, displayCard, weight, other, rating, viewTimes, brand, picture, color, minprice) **Primary Key** productID	**Mobile** (productID, platform, connectivity, physicalSize, weight, screenSize, pixel, battery, softwareApplication, memory, externalMemory, other, rating, viewTimes, brand, picture, color, minprice) **Primary Key** productID

Comment (commentID, productID, memeberID,content, time) **Primary Key** commentID **Foreign Key** memberID **references** Member(memberID) **Foreign Key** productID **references** Product(productID)	**PurchaseLink** (productID, supplierID, price, stock, link) **Primary Key** productID, supplierID **Alternate Key** link **Foreign Key** productID **references** Product(productID) **Foreign Key** supplierID **references** Supplier(supplierID)
StaffPhone (phoneNo, staffID) **Primary Key** phoneNo **Foreign Key** staffID **references** Staff(staffID)	**SupplierTelephone** (telNo, supplierID) **Primary Key** telNo **Foreign Key** supplierID **references** Supplier(supplierID)
ZipcodeAddress (zipCode, nation, country, city, street) **Primary Key** zipCode	

Physical Database Design

Translate logical database design for target DBMS

Design base tables

(1) Base table and choose index for table **Staff**

Table 7 Base table design and choose index for Staff

The physical design of the **Staff** table using an extended DBDL

domain Staff_Identifications	fixed integer length 8
domain First_Names	variable length character string maximum length 15
domain Last_Names	variable length character string maximum length 15
domain LogIn_Passwords	fixed length character string length 40
domain Security_Questions	variable length character string maximum length 40
domain Security_QuestionAnswers	variable length character string maximum length 20
domain Supervisor_Identifications	fixed integer length 8
domain Staff_Positions	variable length character string maximum length 15
domain Staff_Salaries	Variable float maximum length 6
domain Electronic_Mails	variable length character string maximum length 100
domain Address_Names	variable length character string maximum length 35
Person_Genders	variable length character string maximum length 6

Staff (staffID	Staff_Identifications	NOT NULL	UNIQUE	INDEX
fName	First_Names	NOT NULL		
lName	Last_Names	NOT NULL		
password	LogIn_Passwords	NOT NULL		
securityQuestion	Security_Questions	NOT NULL		
securityQuestionAnswer	Security_QuestionAnswers	NOT NULL		
supervisorStaffID	Supervisor_Identifications	NOT NULL	SECONDARY INDEX	
position	Staff_Positions	NOT NULL		
salary	Staff_Salaries	NOT NULL		
e-mail	Electronic_Mails	NOT NULL	UNIQUE	
address	Address_Names	NOT NULL		
gender	Person_Genders	CAN NULL)		

Primary Key staffID

Foreign Key supervisorStaffID **references** Staff(staffID) ON UPDATE CASCADE ON DELETE NO ACTION

(2) Base table and choose index for table **Supplier**

Table 8 Base table design and choose index for Supplier

The physical design of the **Supplier** table using an extended DBDL

Domain Supplier_ Identifications	fixed integer length 8			
domain Supplier_Names	variable length character string maximum length 15			
domain LogIn_Passwords	fixed length character string length 40			
domain Address_Names	variable length character string maximum length 100			
domain Supplier_E-mails	variable length character string maximum length 35			
domain Security_Questions	variable length character string maximum length 40			
domain SecurityQuestion_Answers	variable length character string maximum length 20			
domain Supplier_Ratings	variable float value maximum length 3			
Domain Supplier_Logos	variable length character string maximum length 100			
Supplier (supplierID	Supplier_ Identifications	NOT NULL	UNIQUE	INDEX
supplierName	Supplier_Names	NOT NULL		
password	LogIn_Passwords	NOT NULL		
address	Address_Names	NOT NULL		
e-mail	Electronic_Mails	NOT NULL	UNIQUE	
securityQuestion	Security_Questions	NOT NULL		
securityQuestionAnswer	Security_QuestionAnswers	NOT NULL		
rating	Supplier_Ratings	NOT NULL		
logo	Supplier_Logos	NOT NULL)		

Primary Key supplierID

(3) Base table and choose index for table **Member**

Table 9 Base table design and choose inde for Member

The physical design of the **Member** table using an extended DBDL

domain Member_ Identifications	fixed integer length 8
domain LogIn_Passwords	fixed length character string length 40
domain First_Names	variable length character string maximum length 15
domain Last_Names	variable length character string maximum length 15
domain Member_Genders	variable length character string maximum length 6
domain Zip_Codes	variable length character string maximum length 12
domain Room/House_Numbers	variable length character string maximum length 5
domain Birth_Dates	date type that as the form “YYYY-MM-DD”
domain Member_E-mails	variable length character string maximum length 35
domain Phone_Numbers	variable length character string maximum length 13
domain Telephone_Numbers	fixed length character string length 11
domain Register_Dates	date type that as the form “YYYY-MM-DD”
domain Security_Questions	variable length character string maximum length 40
domain SecurityQuestion_Answers	variable length character string maximum length 20
domain LatestLogIn_Dates	date type that as the form “YYYY-MM-DD”

Member (memberID	Member_ Identifications	NOT NULL	UNIQUE	INDEX
password	LogIn_Passwords	NOT NULL		
fName	First_Names	NOT NULL		
lName	Last_Names	NOT NULL		
gender	Person_Genders	CAN NULL		
zipcode	Zip_Codes	NOT NULL		
roomNo/houseNo	Room/House_Numbers	NOT NULL		
dateOfBirth	Birth_Dates	CAN NULL		
e-mail	Electronic_Mails	NOT NULL	UNIQUE	
phoneNo	Phone_Numbers	CAN NULL		
telNo	Telephone_Numbers	CAN NULL	SECONDARY INDEX	
registerDate	Register_Dates	NOT NULL		
securityQuestion	Security_Questions	NOT NULL		
securityQuestionAnswer	SecurityQuestion_Answers	NOT NULL		
dateOfLatestLogIn	LatestLogIn_Dates	NOT NULL)		

Primary Key memberID

(4) Base table and choose index for table **Feedback**

Table 10 Base table design and choose index for Feedback

The physical design of the **Feedback** table using an extended DBDL

domain Feedback_ Identifications	fixed integer length 8
domain Feedback_Title	variable length character string maximum length 30
domain Member_Identifications	fixed integer length 8
domain Staff_Identifications	fixed integer length 8
domain Feedback_Contents	text type
domain Member_Responses	text type
domain Time_Dates	datetime type that as the form “YYYY-MM-DD HH:MM:SS”
domain Time_Dates	datetime type that as the form “YYYY-MM-DD HH:MM:SS”

Feedback (feedbackID	Feedback_ Identifications	NOT NULL	UNIQUE INDEX
title	Feedback_Title	CAN NULL	
memberID	Member_Identifications	NOT NULL	UNIQUE
staffID	Staff_Identifications	NOT NULL	UNIQUE SECONDARY INDEX
content	Feedback_Contents	NOT NULL	
response	Member_Responses	CAN NULL	
writeTime	Time_Dates	NOT NULL	
responseTime	Time_Dates	CAN NULL)	

Primary Key feedbackID

Foreign Key memberID **references** Member(memberID) ON UPDATE CASCADE ON DELETE NO ACTION

Foreign Key staffID **references** Staff(staffID) ON UPDATE CASCADE ON DELETE NO ACTION

(5) Base table and choose index for table Product

Table 11 Base table design and choose index for Product

The physical design of the **Product** table using an extended DBDL	
domain Product_ Identifications	variable length character string maximum length 30
domain Product_Types	fixed integer value 1 or 2
domain Release_Dates	date type that as the form “YYYY-MM-DD”
domain Product_Pictures	variable length character string maximum length 100

Product (productID	Product_ Identifications	NOT NULL	UNIQUE INDEX
productType	Product_Types	NOT NULL	
releaseDate	Release_Dates	NOT NULL	
picture	Product_Pictures	NOT NULL)	

Primary Key productID

(6) Base table and choose index for table **Computer**

Table 12 Base table design and choose index for Computer

The physical design of the **Computer** table using an extended DBDL

domain Product_ Identifications	variable length character string maximum length 100
domain Computer_Processors	variable length character string maximum length 25
domain Memory_Sizes	variable integer value
domain Computer_Storages	variable integer value
domain Screen_Sizes	variable float maximum length 4
domain Computer_Types	variable length character string maximum length 18
domain Operating_Systems	variable length character string maximum length 10
domain Display_Cards	variable length character string maximum length 30
domain Computer_Weights	variable double maximum length 8
domain Other_Information	text type
domain Product_Ratings	variable float value maximum length 3
domain View_Times	bigint type
domain Product_Colors	variable length character string maximum length 50
domain Product_Brands	variable length character string maximum length 15
domain Product_Pictures	variable length character string maximum length 100
domain Min_Prices	variable float maximum length 8

Computer (productID	Product_ Identifications	NOT NULL	UNIQUE INDEX
processor	Computer_Processors	NOT NULL	
memory	Memory_Sizes	NOT NULL	
storage	Computer_Storages	NOT NULL	
screenSize	Screen_Sizes	CAN NULL	
type	Computer_Types	NOT NULL	SECONDARY INDEX
operatingSystem	Operating_Systems	NOT NULL	
displayCard	Display_Cards	CAN NULL	
weight	Computer_Weights	CAT NULL	
other	Other_Information	CAN NULL	
rating	Product_Ratings	NOT NULL	
viewTimes	View_Times	NOT NULL	
color	Product_Colors	NOT NULL	
brand	Product_Brands	NOT NULL	SECONDARY INDEX
picture	Product_Pictures	NOT NULL	
minprice	Min_Prices	NOT NULL)	

Primary Key computerID

(7) Base table and choose index for table **Mobile**

Table 13 Base table design and choose index for Mobile

The physical design of the **Mobile** table using an extended DBDL

domain Product_ Identifications	variable length character string maximum length 100			
domain Mobile_Platforms	variable length character string maximum length 15			
domain Mobile_Connectivities	variable length character string maximum length 300			
domain Physical_Sizes	variable length character string maximum length 25			
domain Mobile_Weights	variable float maximum length 8			
domain Screen_Sizes	variable float maximum length 4			
domain Mobile_Pixels	variable float maximum length 7			
domain Mobile_Batteries	variable length character string maximum length 200			
domain Software_Applications	variable length character string maximum length 200			
domain Mobile_Memories	variable integer value			
domain External_Memories	variable integer value			
domain Other_Information	text type			
domain Product_Ratings	variable float value maximum length 3			
domain View_Times	bigint type			
domain Product_Colors	variable length character string maximum length 50			
domain Product_Brands	variable length character string maximum length 15			
domain Product_Pictures	variable length character string maximum length 100			
domain Min_Prices	variable float maximum length 8			
Mobile (productID	Product_ Identifications	NOT NULL	UNIQUE	INDEX
platform	Mobile_Platforms	NOT NULL		
connectivity	Mobile_Connectivities	NOT NULL		
physicalSize	Physical_Sizes	NOT NULL		
weight	Mobile_Weights	CAN NULL		
screenSize	Screen_Sizes	NOT NULL		
pixel	Mobile_Pixels	NOT NULL		
battery	Mobile_Batteries	NOT NULL		
softwareApplication	Software_Applications	NOT NULL		
memory	Mobile_Memories	NOT NULL		
externalMemory	External_Memories	CAN NULL		
other	Other_Information	CAN NULL		
rating	Product_Ratings	NOT NULL		
viewTimes	View_Times	NOT NULL		
color	Product_Colors	CAN NULL		
brand	Product_Brands	NOT NULL	SECONDARY INDEX	
picture	Product_Pictures	NOT NULL		
minprice	Min_Prices	NOT NULL)		
Primary Key mobileID				

(8) Base table and choose index for table **Comment**

Table 14 Base table design and choose index for Comment

The physical design of the **Comment** table using an extended DBDL

domain Comment_Identifications	fixed integer length 8
domain Product_Identifications	variable length character string maximum length 100
domain Member_ Identifications	fixed integer length 8
domain Comment_Contents	text type
domain Time_Dates	datetime type that as the form “YYYY-MM-DD HH:MM:SS”

ComputerComment (commentID	Comment_Identifications	NOT NULL	UNIQUE	INDEX
productID	Product_Identifications	NOT NULL	SECONDARY INDEX	
memberID	Member_ Identifications	NOT NULL		
content	Comment_Contents	NOT NULL		
time	Time_Dates	NOT NULL)		

Primary Key commentID
Foreign Key memberID **references** Member(memberID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key productID **references** Product(productID) ON UPDATE CASCADE ON DELETE NO ACTION

(9) Base table and choose index for table **PurchaseLink**

Table 15 Base table design and choose index for PurchaseLink

The physical design of the **PurchaseLink** table using an extended DBDL

domain Product_ Identifications	variable length character string maximum length 100
domain Supplier_Identifications	fixed integer length 8
domain Product_Prices	variable float maximum length 8
domain Product_Stocks	variable length character string maximum length 3
domain Purchase_Links	variable length character string maximum length 500

ComputerPLink (productID	Product_ Identifications	NOT NULL	UNIQUE	INDEX
supplierID	Supplier_Identifications	NOT NULL	UNIQUE	SECONDARY INDEX
price	Product_Prices	NOT NULL		
stock	Product_Stocks	NOT NULL		
link	Purchase_Links	NOT NULL)		

Primary Key productID, supplierID
Alternate Key link
Foreign Key productID **references** Product(productID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key supplierID **references** Supplier(supplierID) ON UPDATE CASCADE ON DELETE NO ACTION

(10) Base table and choose index for table **SupplierTelephone**

Table 16 Base table design and choose index for SupplierTelephone

The physical design of the **SupplierTelephone** table using an extended DBDL

domain Telephone_ Numbers	fixed length character string length 11
domain Supplier_ Identifications	fixed integer length 8

SupplierTelephone(telNo		Telephone_ Numbers	NOT NULL	UNIQUE	INDEX
	supplierID	Supplier_ Identifications	NOT NULL	UNIQUE)	

Primary Key telNo

Foreign Key supplierID **references** Supplier(supplierID) ON UPDATE CASCADE ON DELETE NO ACTION

(11) Base table choose index for table **StaffPhone**

Table 17 Base table design and choose index for StaffPhone

The physical design of the **StaffPhone** table using an extended DBDL

domain Phone_Numbers	variable length character string maximum length 13
domain Staff_ Identifications	fixed integer length 8

Staffphone(phoneNo		Phone_Numbers	NOT NULL	UNIQUE	INDEX
	staffID	Staff_ Identifications	NOT NULL	UNIQUE)	

Primary Key phoneNo

Foreign Key staffID **references** Staff(staffID) ON UPDATE CASCADE ON DELETE NO ACTION

(12) Base table and choose index for table **Web**

Table 18 Base table design and chose for Web

The physical design of the **Web** table using an extended DBDL

domain Web_Names	variable length character string maximum length 20			
domain IP_Addresses	variable length character string maximum length 16			
Web (webName	Web_Name	NOT		
IPaddress	IP_Addresses	NOT NULL	UNIQUE	INDEX)

Primary Key IPaddress

(13) Base table and choose index for table **ZipcodeAddress**

Table 19 Base table design and choose index for ZipcodeAddress

The physical design of the **ZipcodeAddress** table using an extended DBDL

domain Zip_Codes	variable length character string maximum length 12
domain Member_Nations	variable length character string maximum length 50
domain Country_Names	variable length character string maximum length 50
domain City_Names	variable length character string maximum length 20
domain Street_Names	variable length character string maximum length 30

MemberAddress(zipCode		Zip_Codes	NOT NULL	UNIQUE	INDEX
	nation	Member_Nations	NOT NULL		
	country	Country_Names	NOT NULL		

city	City_Names	NOT NULL
street	Street_Names	NOT NULL)

Primary Key zipCode

(14) Partial list of MySQL data types

Table 20 Partial list of MySQL data types

Type	**Size**	**Description**
CHAR[Length]	Length bytes	A fixed-length field from 0 to 255 characters long.
VARCHAR[Length]	String length + 1 bytes	A fixed-length field from 0 to 255 characters long.
TINYTEXT	String length + 1 bytes	A string with a maximum length of 255 characters.
TEXT	String length + 2 bytes	A string with a maximum length of 65,535 characters.
MEDIUMTEXT	String length + 3 bytes	A string with a maximum length of 16,777,215 characters.
LONGTEXT	String length + 4 bytes	A string with a maximum length of 4,294,967,295 characters.
TINYINT[Length]	1 byte	Range of -128 to 127 or 0 to 255 unsigned.
SMALLINT[Length]	2 bytes	Range of -32,768 to 32,767 or 0 to 65535 unsigned.
MEDIUMINT[Length]	3 bytes	Range of -8,388,608 to 8,388,607 or 0 to 16,777,215 unsigned.
INT[Length]	4 bytes	Range of -2,147,483,648 to 2,147,483,647 or 0 to 4,294,967,295 unsigned.
BIGINT[Length]	8 bytes	Range of -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807 or 0 to 18,446,744,073,709,551,615 unsigned.
FLOAT	4 bytes	A small number with a floating decimal point.
DOUBLE[Length, Decimals]	8 bytes	A large number with a floating decimal point.
DECIMAL[Length, Decimals]	Length + 1 or Length + 2 bytes	A DOUBLE stored as a string, allowing for a fixed decimal point.
DATE	3 bytes	In the format of YYYY-MM-DD.
DATETIME	8 bytes	In the format of YYYY-MM-DD HH:MM:SS.
TIMESTAMP	4 bytes	In the format of YYYYMMDDHHMMSS; acceptable range ends inthe year 2037.
TIME	3 bytes	In the format of HH:MM:SS
ENUM	1 or 2 bytes	Short for enumeration, which means that each column can haveone of several possible values.
SET	1, 2, 3, 4, or 8 bytes	Like ENUM except that each column can have more than one ofseveral possible values.

Choose file organization and index

Analyze transactions/transaction analysis form

In our database system, we have 61 transactions (from the transactional requirement). For each transaction, we need to analyze the frequency of it, thus we can use this information to determine the indexes that are required.
Here we just use one transaction to show the analysis form.

<table>
<tr><td colspan="2">Transaction Analysis Form (Modified)

Transaction (43) List the username, content and time for some comments of products according to the given product ID.

Transaction Volume:

Average: 100 000 per hour

Peak: 200 000 per hour (between 18:00 and 22:00 every day of the week)</td></tr>
<tr><td>SELECT content, time, lName, fName

FROM Comment.c

INNER JOIN Product.p ON productID

INNER JOIN Member.m ON memberID

WHERE productID = “00001234”;</td><td>Search condition: productID = “00001234”

Join columns: c.memberID = m.memberID,

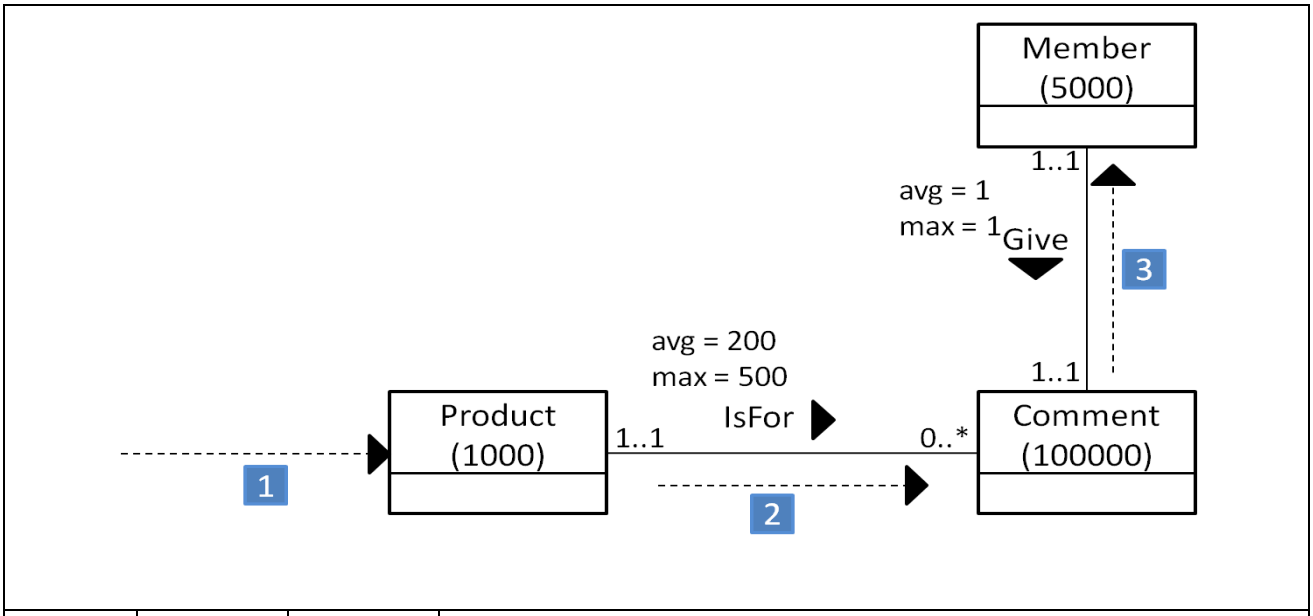
c.productID = p.productID

Ordering column: none

Grouping column: none

Built-in functions: none

Columns updated: none</td></tr>
<tr><td colspan="2">Transaction usage map</td></tr>
</table>



Access	Entity	Types of access	No. of references		
			Per transaction	Avg per hour	Peak per hour
1	Product (entry)	R	1	100 000	200 000
2	Comment	R	0-500	0-50 000 000	0-100 000 000
3	Member	R	0-500	0-50 000 000	0-100 000 000
Total reference			1-1 001	100 000-100 100 000	200 000-200 200 000

Choose file organization

Sometimes, we may use one storage structure to construct the database and then change another way for the normal operational uses, because for some tables, loading data is efficient but extract data from it is not fast using the same structure. So in order to improve the efficiency for each transaction, we need to choose an optimal file organization for each table.

Although sometimes it is no choice for choosing file structures for a relational DBMS, we will try to select an optimal structure. For example, heap files and ordered files.

Design user views

(1) Director

Director maintains (enter, update, and delete) data on web and reports on all data.

Table 24 User views of director (Y: writeable N: not writeable)

Table Name	Readable columns	Writeable
Web	webName	Y
	IPaddress	Y
Staff	staffID	N
	fName	N
	lName	N
	position	N
	salary	N
	supervisorStaffNo	N
	address	N
	e-mail	N
	gender	N
Supplier	supplierID	N
	supplierName	N
	address	N
	e-mail	N
	rating	N
	logo	N
Member	memberID	N
	fName	N
	lName	N
	gender	N
	roomORhouseno	N
	dateOfBirth	N
	e-mail	N
	phoneNo	N
	telNo	N
	registerDate	N
	dateOfLastLogin	N
SupplierTelephone	telNo	N
	supplierID	N
StaffPhone	phoneNo	N
	staffID	N
Product	productID	N
	productType	N
	releaseDate	N
	picture	N
Computer	productID	N
	processor	N
	memory	N
	storage	N
	screenSize	N

	type	N
	operatingSystem	N
	displayCard	N
	weight	N
	other	N
	rating	N
	viewTimes	N
	brand	N
	picture	N
	color	N
	minprice	N
Mobile	productID	N
	platform	N
	connectivity	N
	physicalSize	N
	weight	N
	screenSize	N
	pixel	N
	battery	N
	softwareApplication	N
	memory	N
	externalMemory	N
	other	N
	rating	N
	viewTimes	N
	brand	N
	picture	N
	color	N
	minprice	N
Comment	commentID	N
	memberID	N
	productID	N
	content	N
	time	N
PurchaseLink	productID	N
	supplierID	N
	price	N
	stock	N
	link	N
Feedback	feedbackID	N
	title	N
	memberID	N
	staffID	N

	content	N
	response	N
	writeTime	N
	responseTime	N
ZipcodeAddress	zipCode	N
	nation	N
	country	N
	city	N
	street	N

(2) Manager

Manager maintains (enter, update, and delete) data on staff the whole web and reports on staff feedbacks at the whole web.

Table 25 User views of manager (Y: writeable N: not writeable)

Table Name	Readable columns	Writeable
Web	webName	N
	IPaddress	N
Staff	staffID	Y
	fName	Y
	lName	Y
	position	Y
	salary	Y
	supervisorStaffNo	Y
	address	Y
	e-mail	Y
	gender	Y
StaffPhone	phoneNo	Y
	staffID	Y
Feedback	feedbackID	N
	title	N
	memberID	N
	staffID	N
	content	N
	response	N
	writeTime	N
	responseTime	N

(3) Supervisor

Supervisor is able to maintain (enter, update, and delete) data on supplier, members, feedbacks, purchase links, and zip code address. Supervisor is able to report on suppliers, members, feedbacks, purchase links and zip code address at the whole web.

Table 26 User views of supervisor (Y: writeable N: not writeable)

Table Name	Readable columns	Writeable
Web	webName	N
	IPaddress	N
Supplier	supplierID	Y
	supplierName	Y
	address	Y
	e-mail	Y
	rating	Y
	logo	Y
Member	memberID	Y
	fName	Y
	lName	Y
	gender	Y
	roomORhouseno	Y
	dateOfBirth	Y
	e-mail	Y
	phoneNo	Y
	telNo	Y
	registerDate	Y
	dateOfLastLogin	Y
PurchaseLink	productID	Y
	supplierID	Y
	price	N
	stock	N
	link	N
Feedback	feedbackID	Y
	title	N
	memberID	Y
	staffID	N
	content	N
	response	Y
	writeTime	N
	responseTime	N
ZipcodeAddress	zipCode	Y
	nation	Y
	country	Y
	city	Y
	street	Y

(4) Staff

Staff is able to maintain (enter, update, and delete) data on product, computers and mobiles, comments, and data details on purchase links. Staff can report on staff, supplier, members,

product, computers and mobiles, comments and purchase link at given part of the web.

Table 27 User views of staff (Y: writeable N: not writeable)

Table Name	Readable columns	Writeable
Web	webName	N
	IPaddress	N
Staff	staffID	N
	fName	N
	lName	N
	position	N
	salary	N
	supervisorStaffNo	N
	address	N
	e-mail	N
	gender	N
Supplier	supplierID	N
	supplierName	N
	address	N
	e-mail	N
	rating	N
	logo	N
Member	memberID	N
	fName	N
	lName	N
	gender	N
	roomORhouseno	N
	dateOfBirth	N
	e-mail	N
	phoneNo	N
	telNo	N
	registerDate	N
	dateOfLastLogin	N
SupplierTelephone	telNo	N
	supplierID	N
StaffPhone	phoneNo	N
	staffID	N
Product	productID	Y
	productType	Y
	releaseDate	Y
	picture	Y
Computer	productID	Y
	processor	Y
	memory	Y

	storage	Y
	screenSize	Y
	type	Y
	operatingSystem	Y
	displayCard	Y
	weight	Y
	other	Y
	rating	N
	viewTimes	N
	brand	Y
	picture	Y
	color	Y
	minprice	Y
Mobile	productID	Y
	platform	Y
	connectivity	Y
	physicalSize	Y
	weight	Y
	screenSize	Y
	pixel	Y
	battery	Y
	softwareApplication	Y
	memory	Y
	externalMemory	Y
	other	Y
	rating	N
	viewTimes	N
	brand	Y
	picture	Y
	color	Y
	minprice	Y
Comment	commentID	Y
	memberID	N
	productID	N
	content	N
	time	N
PurchaseLink	productID	Y
	supplierID	N
	price	Y
	stock	Y
	link	Y

(5) Supplier

Supplier is able to report on suppliers, computers and mobiles, comments and purchase links at given part of web.

Table 28 User views of supplier (Y: writeable N: not writeable)

Table Name	Readable columns	Writeable
Supplier	supplierID	N
	supplierName	N
	address	N
	e-mail	N
	rating	N
	logo	N
Computer	productID	N
	processor	N
	memory	N
	storage	N
	screenSize	N
	type	N
	operatingSystem	N
	displayCard	N
	weight	N
	other	N
	rating	N
	viewTimes	N
	brand	N
	picture	N
	color	N
	minprice	N
Mobile	productID	N
	platform	N
	connectivity	N
	physicalSize	N
	weight	N
	screenSize	N
	pixel	N
	battery	N
	softwareApplication	N
	memory	N
	externalMemory	N
	other	N
	rating	N
	viewTimes	N
	brand	N
	picture	N

	color	N
	minprice	N
Comment	commentID	N
	memberID	N
	productID	N
	content	N
	time	N
PurchaseLink	productID	N
	supplierID	N
	price	N
	stock	N
	link	N

(6) Member

Member is able to maintain (enter, update, and delete) data on his or her own information. Member is able to report on computers and mobiles, suppliers, comments, feedbacks and purchase links at given part of web.

Table 29 User views of member (Y: writeable N: not writeable)

Table Name	Readable columns	Writeable
Supplier	supplierID	N
	supplierName	N
	address	N
	e-mail	N
	rating	N
	logo	N
Member	memberID	N
	fName	N
	lName	N
	gender	N
	roomORhouseno	N
	dateOfBirth	N
	e-mail	N
	phoneNo	N
	telNo	N
	registerDate	N
	dateOfLastLogin	N
Computer	productID	N
	processor	N
	memory	N
	storage	N
	screenSize	N
	type	N

	operatingSystem	N
	displayCard	N
	weight	N
	other	N
	rating	N
	viewTimes	N
	brand	N
	picture	N
	color	N
	minprice	N
Mobile	productID	N
	platform	N
	connectivity	N
	physicalSize	N
	weight	N
	screenSize	N
	pixel	N
	battery	N
	softwareApplication	N
	memory	N
	externalMemory	N
	other	N
	rating	N
	viewTimes	N
	brand	N
	picture	N
	color	N
	minprice	N
Comment	commentID	N
	memberID	N
	productID	N
	content	N
	time	N
PurchaseLink	productID	N
	supplierID	N
	price	N
	stock	N
	link	N
Feedback	feedbackID	N
	title	N
	memberID	N
	staffID	N
	content	N

	response	N
	writeTime	N
	responseTime	N

(7) Visitor

Visitor is able to report on computers and mobiles, suppliers, comments and purchase links at given part of web.

Table 30 User views of visitor (Y: writeable N: not writeable)

Table Name	Readable columns	Writeable
Supplier	supplierID	N
	supplierName	N
	address	N
	e-mail	N
	rating	N
	logo	N
Computer	productID	N
	processor	N
	memory	N
	storage	N
	screenSize	N
	type	N
	operatingSystem	N
	displayCard	N
	weight	N
	other	N
	rating	N
	viewTimes	N
	brand	N
	picture	N
	color	N
	minprice	N
Mobile	productID	N
	platform	N
	connectivity	N
	physicalSize	N
	weight	N
	screenSize	N
	pixel	N
	battery	N
	softwareApplication	N
	memory	N
	externalMemory	N

	other	N
	rating	N
	viewTimes	N
	brand	N
	picture	N
	color	N
	minprice	N
PurchaseLink	productID	N
	supplierID	N
	price	N
	stock	N
	link	N

Design security mechanisms

Each database user is assigned an authorization identifier by the Database administrator, which is used to determine which database object that user may reference, and what operations may perform; in order to achieve security, the identifier has an associated password. Each object that is created in SQL has an owner, who is identified by the authorization identifier. By default, the owner is the only person who may know of the existence of the object and perform any operations on the object. Privilege is an action that a user is permitted to carry out on a given base table to view. Once the owner creates a table, he or she receives full privileges on the view. Other users have no privileges on the newly created table. To give them access to the newly created table, the owner has to explicitly gran them the necessary privileges using the SQL GRANT statement.

Design controlled redundancy

(1) Combining one-to-one (1:1) relationships *(Modified)*

For the table that are frequently referenced together and infrequently referenced separately, we will combine the two tables into one. For instance, in our system, we will consider merging the table of Product and PurchaseLink, if customers often view the purchase information along with the product.

(2) Duplicating nonkey columns in one-to-many (1:*) relationships to reduce joins *(Modified)*

For our system, whenever the PurchaseLink table is accessed, it is very common for the name of supplier to be access simultaneously, the SQL query is like:

SELECT p.*, s.supplierName
FROM PurchaseLink p, Supplier s
WHERE p.supplierID = s.supplierID **AND** productID=’00000001’

Therefore, we will consider duplicating the supplierName column in the PurchaseLink table; then

the Supplier table can be removed from the query, now SQL query becomes:

```
SELECT p.*
FROM PurchaseLink p
WHERE productID='00000001'
```

However, after doing this, there is problem to maintain consistency of multiple tables. If the column in parent table is updated, it has to be updated in each child table. It is difficult to make all copies consistent. Also, duplication costs more storage space.

(3) Creating extract tables

To run certain reports at peak time of a day, an extract table based on required table by report can be generated, if the data of report is relatively static or not have to be current. At this point, users can access the extract table instead of base one. To get it, it is better to choose the time when the system is lightly loaded and create and populate tables.

(4) Partitioning tables *(Modified)*

In this system, many tables might contain hundreds of thousands of records. Thus, it is necessary to decompose them into smaller and more manageable pieces with partitions. For instance, range partition can be applied to Comment table with following SQL statement:

```
CREATE TABLE Comment_Partition (
                commentID CHAR(8) NOT NULL,
                memeberID CHAR(8) NOT NULL,
                productID CHAR(15) NOT NULL,
                content CHAR(1000) NOT NULL,
                time DATETIME(19) NOT NULL,
                PRIMARY KEY commentID,
                FOREIGN KEY memberID REFERENCES Member(memberID),
                FOREIGN KEY productID REFERENCES Product(productID))
PARTITION BY RANGE (memberID)
(PARTITION member_range_1 values less than (20121000) TABLESPACE TB01,
 PARTITION member_range_2 values less than (20122000)TABLESPACE TB02,
PARTITION member_range_3 values less than (20123000)TABLESPACE TB03,
 PARTITION member_range_4 values less than (20124000)TABLESPACE TB04,
 PARTITION member_range_5 values less than (20125000)TABLESPACE TB05,);
```

For implementation, we will choose the most efficient approach to divide table; hash partition, list partition or composite partition may be used.

Monitor and tune operational system

In order to improve the performance of the system, our group monitors and tunes the operating system after we design the whole system.

(1) Main memory

Considering that the main memory access is much faster than secondary storage access, the more main memory available to the database applications, the faster the application programs can run. In order to use main memory optimally, we need to minimize the part of main memory that can be accessed, and the good way is set the range of available main memory from 5 percent to 10 percent. Sometimes, we need to swap the pages between main memory and disk to improve the performance of main memory.

(2) CPU

The CPU is in charge of the other system resources and runs users' processes, so it needs to be utilized. When the operating system or application programs make too many requests to the CPU, the CPU bottlenecks occur, which then can cause excessive paging.

In order to prevent the CPU bottlenecks and excessive paging, we can make sure that no unnecessary processes are running during peak time and these unnecessary processes can run in off-hours instead.

(3) Disk I/O

Disk contention occurs when multiple processes want to access the same disk simultaneously. One way to avoid this is that the storage should be distributed across available drives to reduce the likelihood of problems occurring. We can move the heavy accessed files to a less active disk (load balancing) if the disk is still overloaded.

(4) RAID

RAID works on when there is a large disk array comprising an arrangement of several independent disks, and the performance is improved by data striping, that means the data is segmented into equal-size partitions.

Business Rules

There are **six** types of business rules, namely: required data, column domain constraints, entity integrity, multiplicity, referential integrity and other business rules.

Four business rules were identified in previous steps and documented in the data dictionary: **required data, column domain constraints, entity integrity** and **multiplicity.**

Other **two** business rules:

(1) Referential integrity

a) Identify whether nulls are allowed for the foreign key.

b) Identify the existence constraints under which a foreign key may be inserted, updated, or

deleted.

Table 31 Table of the integrity of foreign keys

Staff
Foreign Key supervisorStaffID **references** Staff(staffID) ON UPDATE CASCADE ON DELETE NO ACTION
Feedback
Foreign Key memberID **references** Member(memberID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key staffID **references** Staff(staffID) ON UPDATE CASCADE ON DELETE NO ACTION
Comment
Foreign Key memberID **references** Member(memberID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key productID **references** Product(productID) ON UPDATE CASCADE ON DELETE NO ACTION
PurchaseLink
Foreign Key productID **references** Product(productID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key supplierID **references** Supplier(supplierID) ON UPDATE CASCADE ON DELETE NO ACTION
SupplierTelephone
Foreign Key supplierID **references** Supplier(supplierID) ON UPDATE CASCADE ON DELETE NO ACTION
StaffPhone
Foreign Key staffID **references** Staff(staffID) ON UPDATE CASCADE ON DELETE NO ACTION

(2) Other business rules

a) Validation rules for fields

Using plain English to express business rules

1. Registered users have to provide valid name, surname, e-mail, password (twice to check spelling), zipcode and room/house no. , choice security question and answer it, agree to our Privacy Policy and input write captcha become members.
2. The password must have at least 8 and at most 16 characters.
3. The e-mail address has to write as format of xxx@.domain.
4. The rating can only be number {0, 0.5, 1, 1.5 2, 2.5, 3, 3.5, 4, 4.5, 5}.
5. The gender can only be "male" or "female".
6. The dateofBirth range is "Date()-6 years~Date()-100years", for example, "02/05/1990"
7. The dateOfLatestLogIn need <"Date()", for example, "02/05/2012".
8. The stock can only be letters "Yes" or "No".
9. The feedbackID can only include numbers and letters.
10. The zipCode can only be the form "LetterNum NumLetterLetter", for example, "W5 5SA".

b) Others

Some other rules

1. Members can see unlimited amount of data from database.
2. Only members (visitors after registration) can comment on products.

3. Only members (visitors after registration) can communicate with staff.
4. Stock is to be re-ordered when the stock level is less than the current lead time less two weeks.
5. Member, staff and supplier has to provide valid e-mail, input write captcha to login.

Transaction/Table Matrix

Cross-referencing transactions and tables

I:insert ; R:read ; U:update ; D:delete

(1) Enter the details of a new member.

(2) Enter the details of a new staff.

(3) Enter the details of a new mobile.

(4) Enter the details of a new computer.

(5) Enter the details of a new supplier.

(6) Enter the details of a new comment of a product written by a member.

Transaction/ Table	**(1)**				**(2)**				**(3)**				**(4)**				**(5)**				**(6)**			
	I	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**
Staff					X																			
Member	X																							
Mobile									X															
Computer													X											
PurchaseLink									X				X											
Product									X				X											
Web																								
Supplier																	X							
Comment																					X			
ZipcodeAddress																								
Feedback																								
SupplierTelephone																	X							
StaffPhone					X																			

(7) Enter the details of a new feedback written by a member.

(8) Enter the details of a new product (computer or mobile).

(9) Enter the details of a zip code with its corresponding address.

(10) Enter the details of a telephone number of a supplier.

(11) Enter the details of a phone number of a staff.

(12) Update/delete the details of a member, together with comments and feedbacks the member gave.

Transaction/ Table	**(7)**				**(8)**				**(9)**				**(10)**				**(11)**				**(12)**			
	I	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**
Staff																								
Member																						X	X	X
Mobile					X																			
Computer					X																			
PurchaseLink					X																			
Product					X																			
Web																								
Supplier																								
Comment																						X	X	X
ZipcodeAddress									X															
Feedback	X																					X	X	X
SupplierTelephone													X											
StaffPhone																	X							

(13) Update/delete the details of a staff, together with the phone number and responses to feedback the staff gave.

(14) Update/delete the details of a mobile, together with comments and the purchase link.

(15) Update/delete the details of a computer, together with the comments and the purchase link.

(16) Update/delete the details of a product, together with the corresponding computer or mobile, the comments and the purchase link.

(17) Update/delete the details of a cooperative supplier, with its telephone number and the purchase link.

(18) Update/delete the details of a purchase link of a mobile.

Transaction/ Table	**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**

	I	R	U	D	I	R	U	D	I	R	U	D	I	R	U	D	I	R	U	D	I	R	U	D
Staff		X	X	X																				
Member																								
Mobile						X	X	X						X	X	X		X	X	X		X	X	X
Computer										X	X	X		X	X	X		X	X	X				
PurchaseLink						X	X	X		X	X	X		X	X	X		X	X	X		X	X	X
Product						X	X	X		X	X	X		X	X	X		X	X	X		X	X	X
Web																								
Supplier																		X	X	X				
Comment						X	X	X		X	X	X		X	X	X						X	X	X
ZipcodeAddress																								
Feedback		X	X	X																				
SupplierTelephone																		X	X	X				
StaffPhone		X	X	X																				

(19) Update/delete the details of a purchase link of a computer.

(20) Update/delete the details of a comment of a product (computer/mobile).

(21) Update/delete the details of a feedback.

(22) Update/delete the details of the telephone numbers of a supplier.

(23) Update/delete the details of the phone numbers of a staff.

(24) Update the details of the web.

Transaction/ Table	**(19)**				**(20)**				**(21)**				**(22)**				**(23)**				**(24)**			
	I	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**
Staff																								
Member																								
Mobile																								
Computer		X	X	X																				
PurchaseLink		X	X	X																				
Product		X	X	X																				
Web																						X	X	X
Supplier																								
Comment		X	X	X		X	X	X																
ZipcodeAddress																								
Feedback										X	X	X												
SupplierTelephone														X	X	X								
StaffPhone																		X	X	X				

(25) Update/delete the details of a zip code address.

(26) List the contact details of a supplier referring to a supplier's given ID.

(27) List the information with the telephone number of a supplier according to a supplier's given ID.

(28) List all products that offered by a supplier according to the supplier's ID.

(29) List the information with the phone numbers of a staff record according to a given staff ID.

(30) List the information of one member according to a given member ID.

Transaction/ Table	**(25)**				**(26)**				**(27)**				**(28)**				**(29)**				**(30)**			
	I	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**
Staff																		X						
Member																						X		
Mobile														X										
Computer														X										
PurchaseLink																								
Product														X										
Web																								
Supplier						X				X				X										
Comment																								
ZipcodeAddress		X	X	X																				
Feedback																								
SupplierTelephone						X				X														
StaffPhone																		X						

(31) List the email of some members according to a given gender or date of birthday.

(32) List the password and other personal information of one member according to the given member ID and the given answer of the security question.

(33) List the information of some members that the dates when they last log in are before the given date.

(34) List the information of a product with the purchase link, comments and the information of its corresponding computer or mobile.

(35) List the information of a mobile according to the given mobile ID.

(36) List all records of mobiles ordered by the rating, release time or view times of them.

Transaction/ Table	**(31)**				**(32)**				**(33)**				**(34)**				**(35)**				**(36)**			
	I	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**
Staff																								
Member	X					X				X														

Mobile													X				X				X		
Computer													X										
PurchaseLink													X										
Product													X										
Web																							
Supplier																							
Comment													X										
ZipcodeAddress																							
Feedback																							
SupplierTelephone																							
StaffPhone																							

(37) List the information of some mobiles according to one given parameter or some given parameters, and ordered by price, rating or release time.

(38) List the information of a computer according to the given computer ID.

(39) List all records of computers ordered by the rating, release time or view times of them.

(40) List the information of some computers according to one given parameter or some given parameters, and ordered by price, rating or release time.

(41) List the information of one purchase link of a product according to the given product ID and supplier ID.

(42) List the price and stock of some purchase links of one product according to the given product ID, with the information of the supplier, ordered by price or rating of the supplier.

Transaction/ Table	**(37)**				**(38)**				**(39)**				**(40)**				**(41)**				**(42)**			
	I	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**
Staff																								
Member																								
Mobile		X																				X		
Computer						X				X				X								X		
PurchaseLink																		X				X		
Product																		X				X		
Web																								
Supplier																		X				X		
Comment																								
ZipcodeAddress																								
Feedback																								
SupplierTelephone																								
StaffPhone																								

(43) List the username, content and time for some comments of products according to the given product ID.

(44) List the information of one feedback according to the feedback ID.

(45) List the information of one address according to the given zip code.

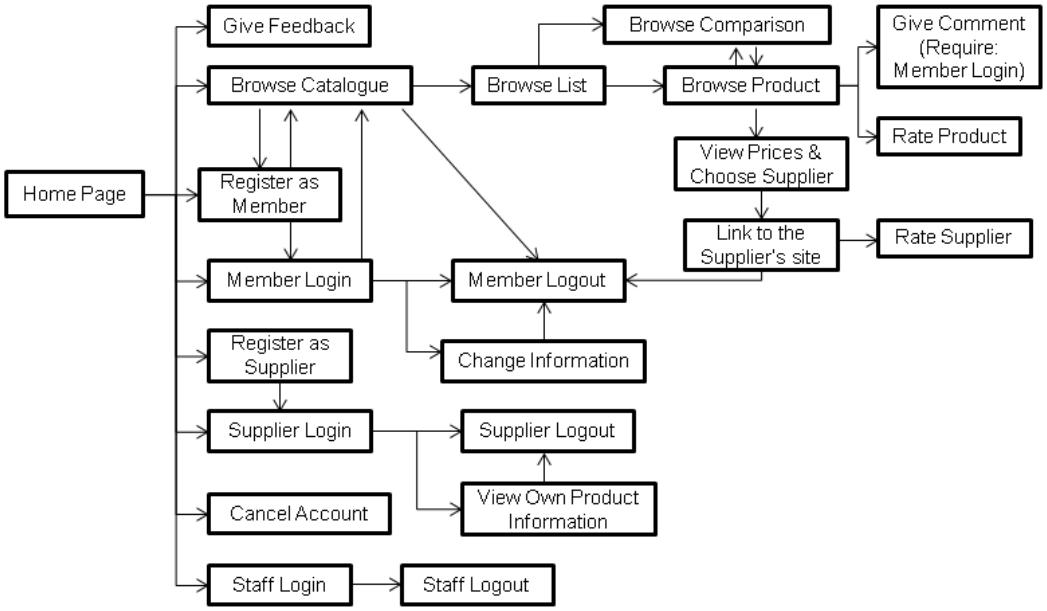
(46) List the information of all records of one product (computer/mobile), with the information of suppliers, that ordered by the price and view times.

Transaction/ Table	**(43)**				**(44)**				**(45)**				**(46)**											
	I	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**	**I**	**R**	**U**	**D**
Staff																								
Member																								
Mobile														X										
Computer														X										
PurchaseLink														X										
Product														X										
Web																								
Supplier														X										
Comment		X																						
ZipcodeAddress										X														
Feedback						X																		
SupplierTelephone														X										
StaffPhone																								

Process Design

Process map

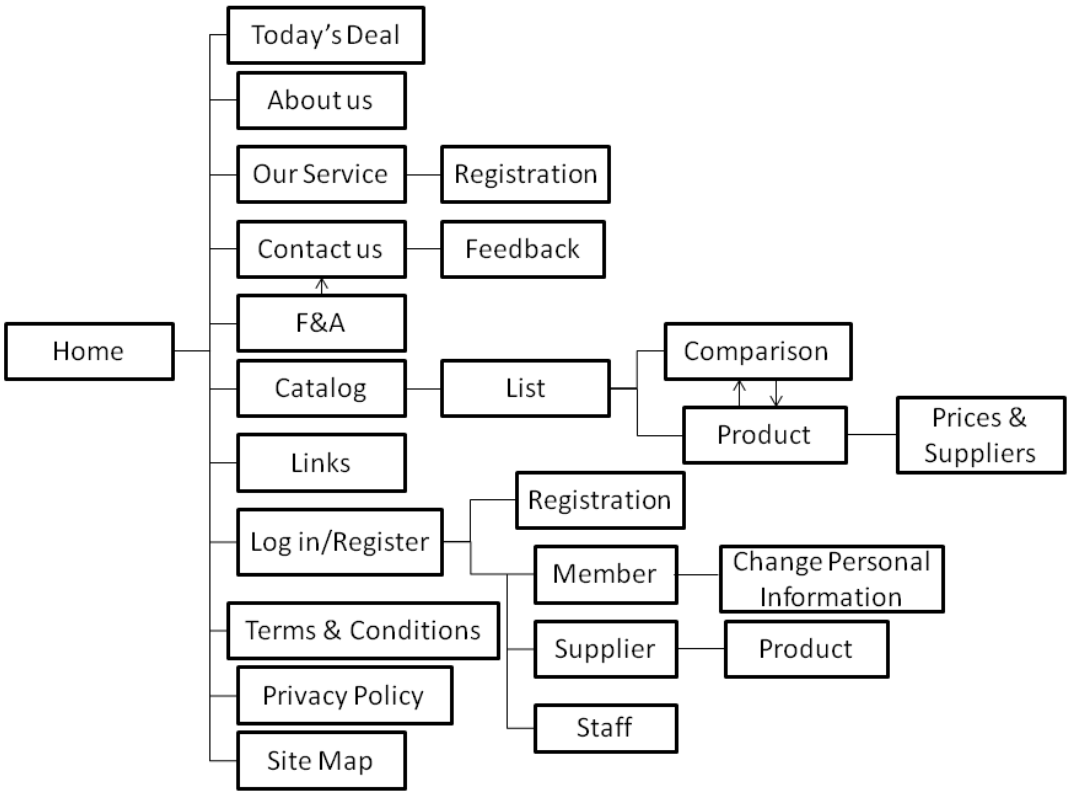
Figure 2 Process map of the web *(Modified)*



User Interface Design

Navigation structure chart

Figure 3 The web site map of the system *(Modified)*



Web pages design

(1) Style

Layout: Fixed-width

(2) Page Size *(Modified)*

Width: 1015 pixels Length: Fluid (Not exceed 2000 pixels)

(3) Top Bar (Fixed for all pages)

Top Bar Background Color (Primary Color): Slate blue (#357EC7)

Logo: Fixed on the left top side of all pages

(4) Background

Color: Clean & White

(5) Color

Primary Color: Slate blue (#357EC7)

Secondary Color: White (#FFFFFF)

Third Color: Black (#000000)

Fourth Color: Grey (#888C8C)

(6) Font

Style: Arial (Content), Verdana, Georgia (Title)

Title Size: Large (30 pixels)

Content Size: Medium (16 pixels)

Title Color (Primary Color): Slate blue (#357EC7)

Content Color (Third Color): Black (#000000)

(7) Menu (Navigation)

Home, New Release, Today's Deal, About us, Our Service, Contact us and Need Help.

(8) Catalog (On left side of Home Page)

a) Computer

Desktop, Laptop and All-in-one Desktop

b) Mobile Phone

Windows, IOS, Android, Blackberry RIM, Symbian and Other

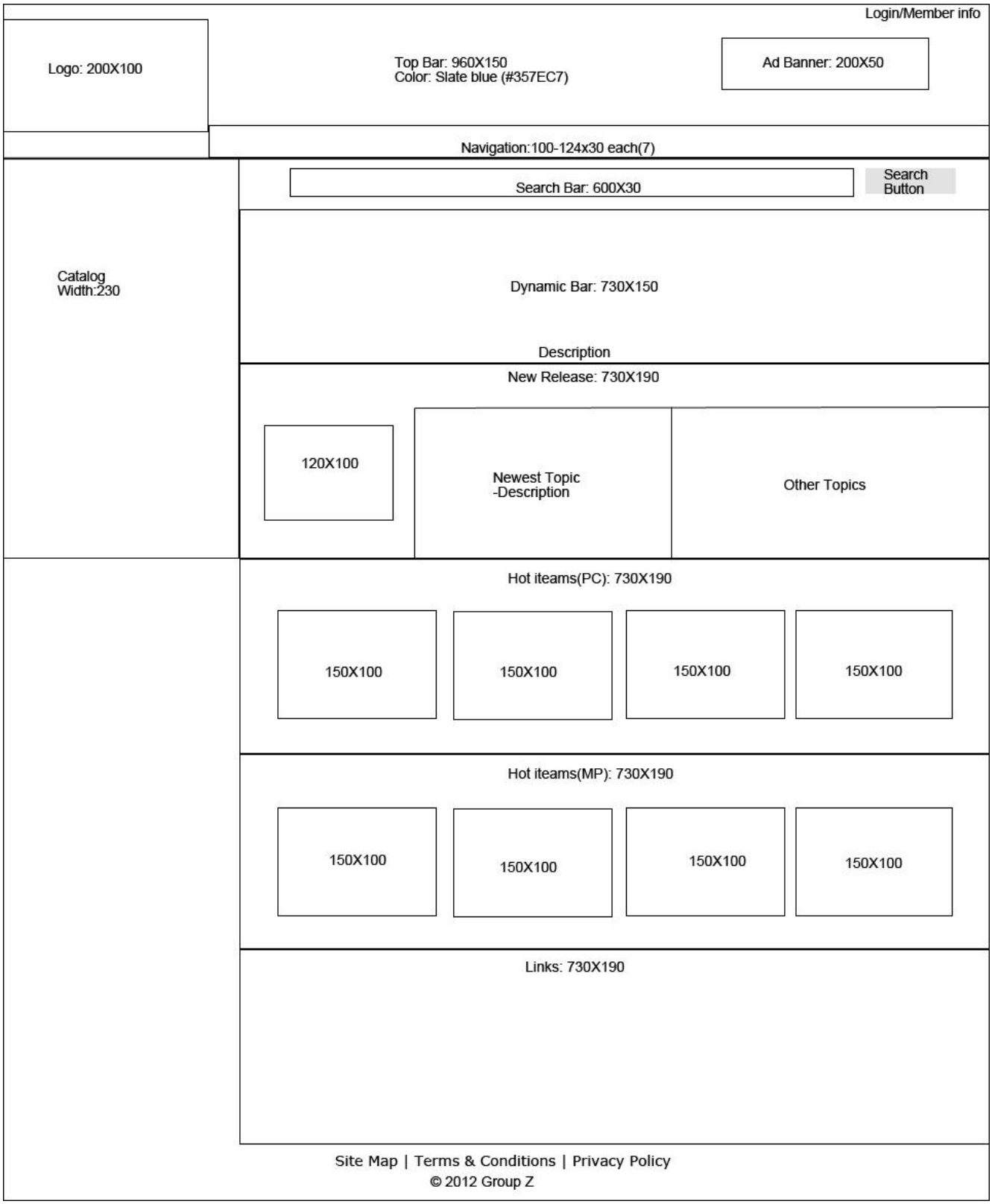
(9) Pages design *(Modified)*

Page	Description
Home	Top Bar/Logo (On each page) Navigation (On each page) Search Bar (On most page) Titles/Contents Left-side Catalog (On most page) Link to New Release Links to Hot Items in PC & MP Bookmark Sites

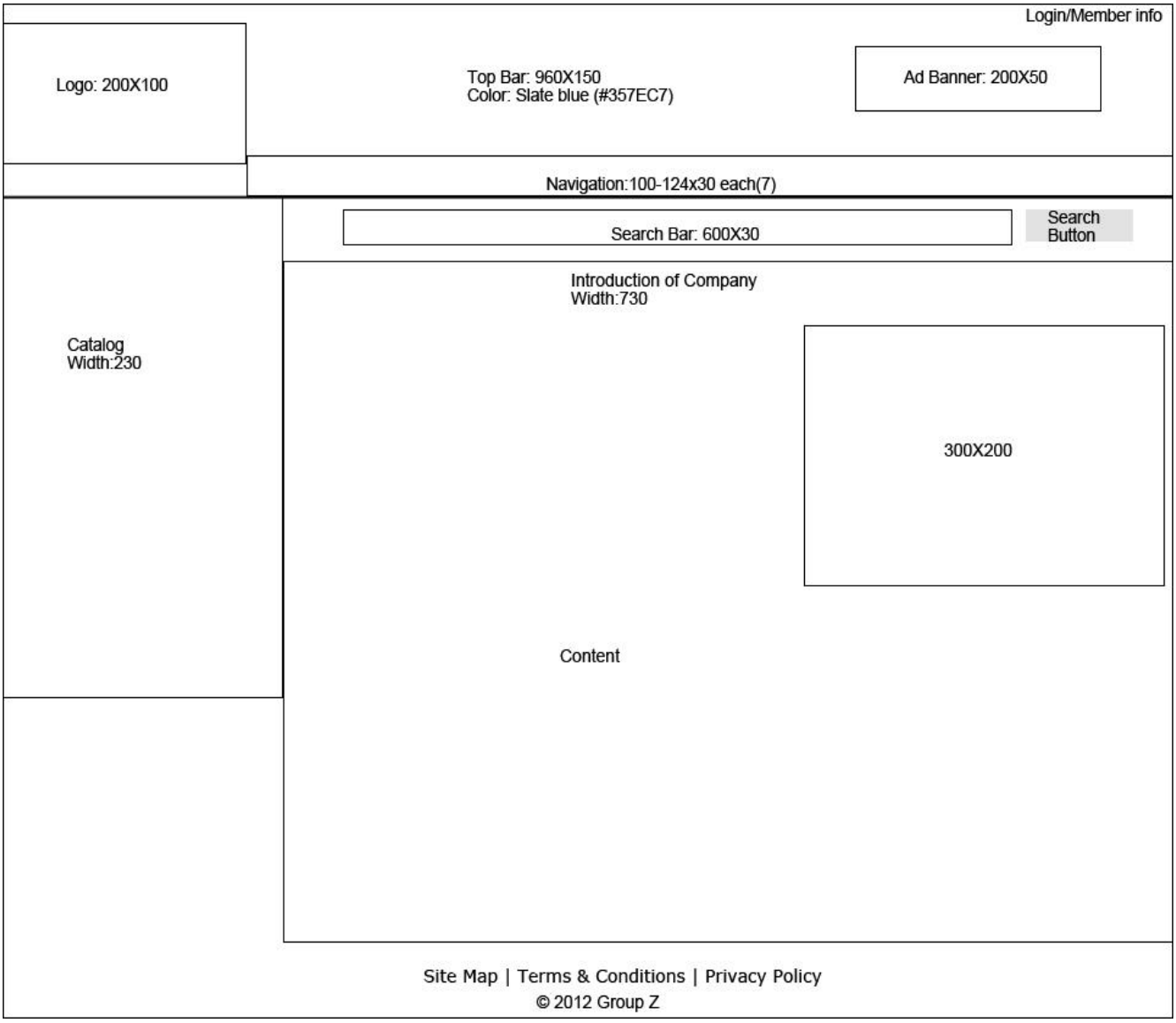
About us	Introduction of our Company
Our Service & With us	Introduction of what we do for visitors and members Method to be a supplier (Email contact)
Contact us & Join us	Email, Telephone, Facebook, Twitter *(Modified)* Join us Methods Link to Feedback
Feedback	Given Feedbacks Staff's Responds New Feedback
Today's Deal *(Modified)*	Computer Special Offers List (Ordered by price) Mobile Phone Special Offers List (Ordered by price)
List (Search Result)	Ordered Basic info of Products Choices of Attribute Range Sorting Method for Search Results *(Modified)* Links to Product (Single) Links to Products Comparison (Select at most three products)
Product	Single Product info Member's Comments Link to Prices & Suppliers (Purchase) Link to Add to Basket (Add product to Comparison) *(Modified)* Link to Products Comparison (Go to Basket) *(Modified)*
Products Comparison	Multiple Products info (Two or three-column table) Links to Single Product
Prices & Suppliers	Particular Prices to such Suppliers Stock info & Supplier Rating Links to Purchase (Transfer to thirty parties)
Login	Username, Password Link to Registration Page Link to find forgotten password (Send email) *(Modified)*
Registration (Only member)	General Registration info
Member Profile (Only member)	Basic info Link to Change Personal Information *(Modified)*
Supplier Profile (Only supplier)	Basic info (Different to member) Links to View Own Products *(Modified)*
Staff Profile (Only staff)	Basic info
Change Personal Information (Only member) *(Modified)*	Change Member Personal info Link to back to Member Profile
Help (F&A)	Frequently Asked Questions & Answers Link to Contact us
Terms & Conditions	Legal Issues
Privacy Policy	What Data We Collected for What
Site Map	Links to All Website Pages

Story boards

(1) Home



(2) About us


Login/Member info
Logo: 200X100
Top Bar: 960X150
Color: Slate blue (#357EC7)
Ad Banner: 200X50
Navigation:100-124x30 each(7)
Search Bar: 600X30
Search Button
Introduction of Company
Width:730
Catalog
Width:230
300X200
Content
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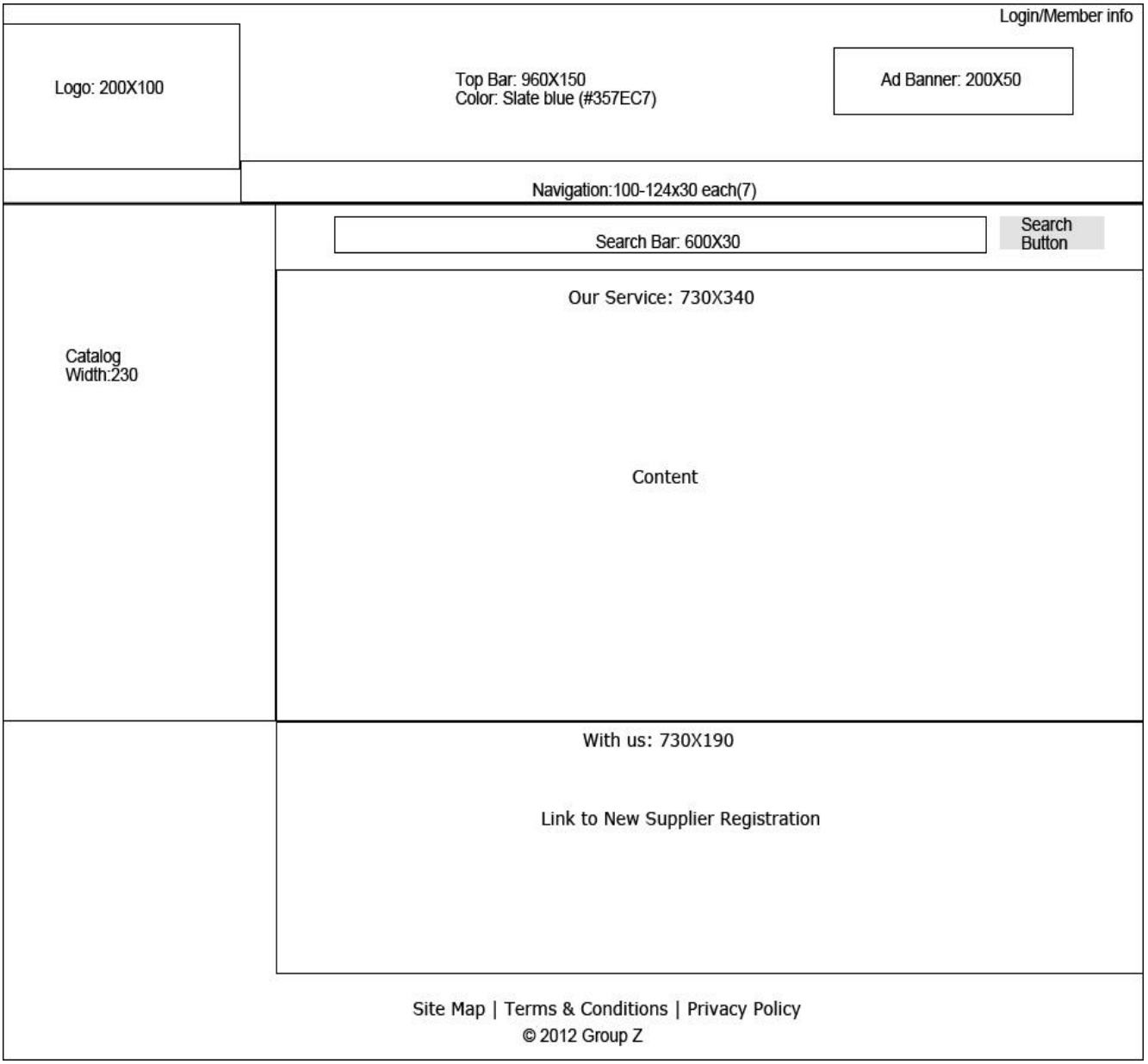
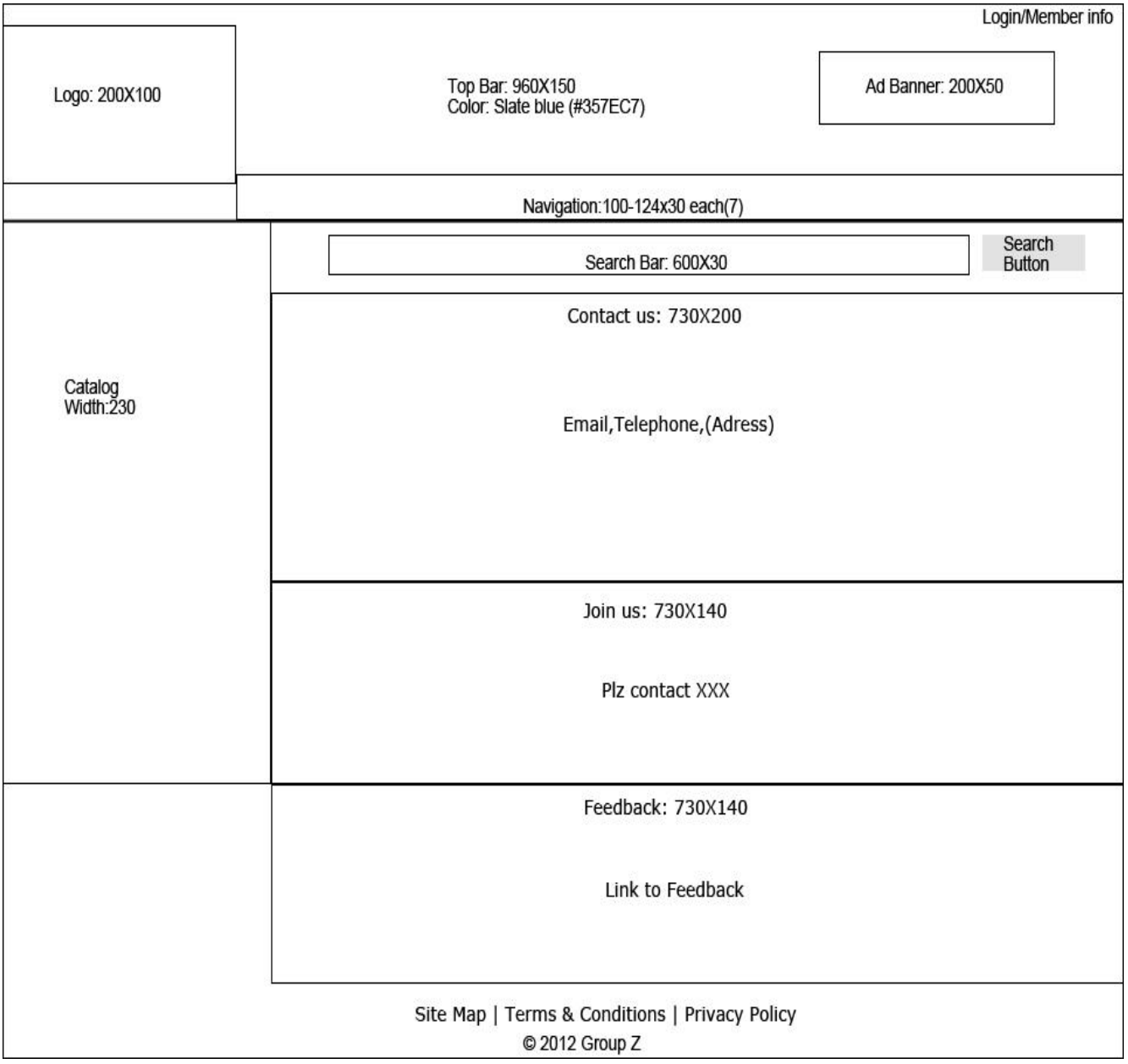
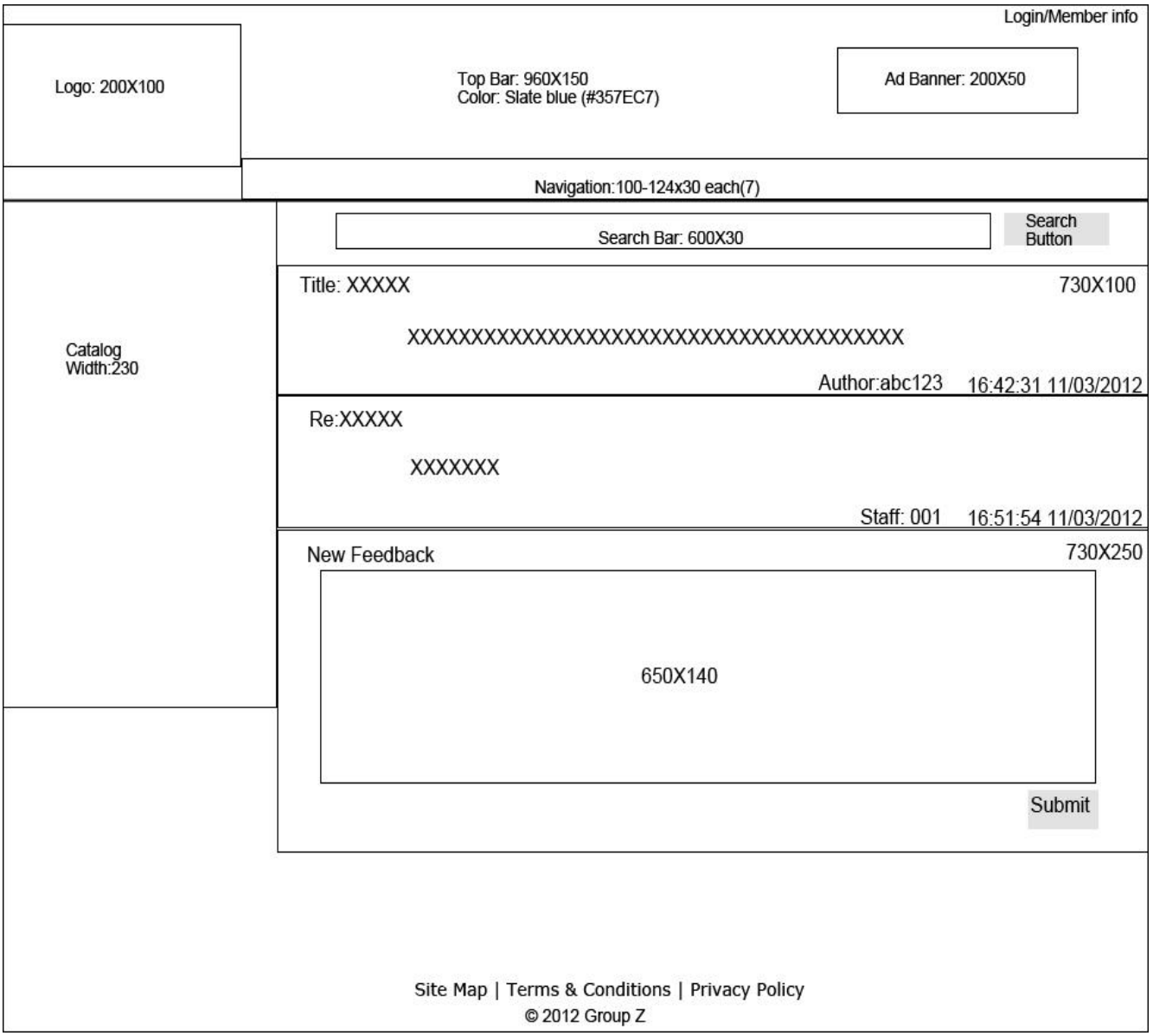
(3) Our Service & With us



(4) Contact us & Join us



(5) Feedback


Login/Member info
Logo: 200X100
Top Bar: 960X150
Color: Slate blue (#357EC7)
Ad Banner: 200X50
Navigation:100-124x30 each(7)
Search Bar: 600X30
Search Button
Title: XXXXX
730X100
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Author:abc123 16:42:31 11/03/2012
Catalog
Width:230
Re:XXXXX
XXXXXXX
Staff: 001 16:51:54 11/03/2012
New Feedback
730X250
650X140
Submit
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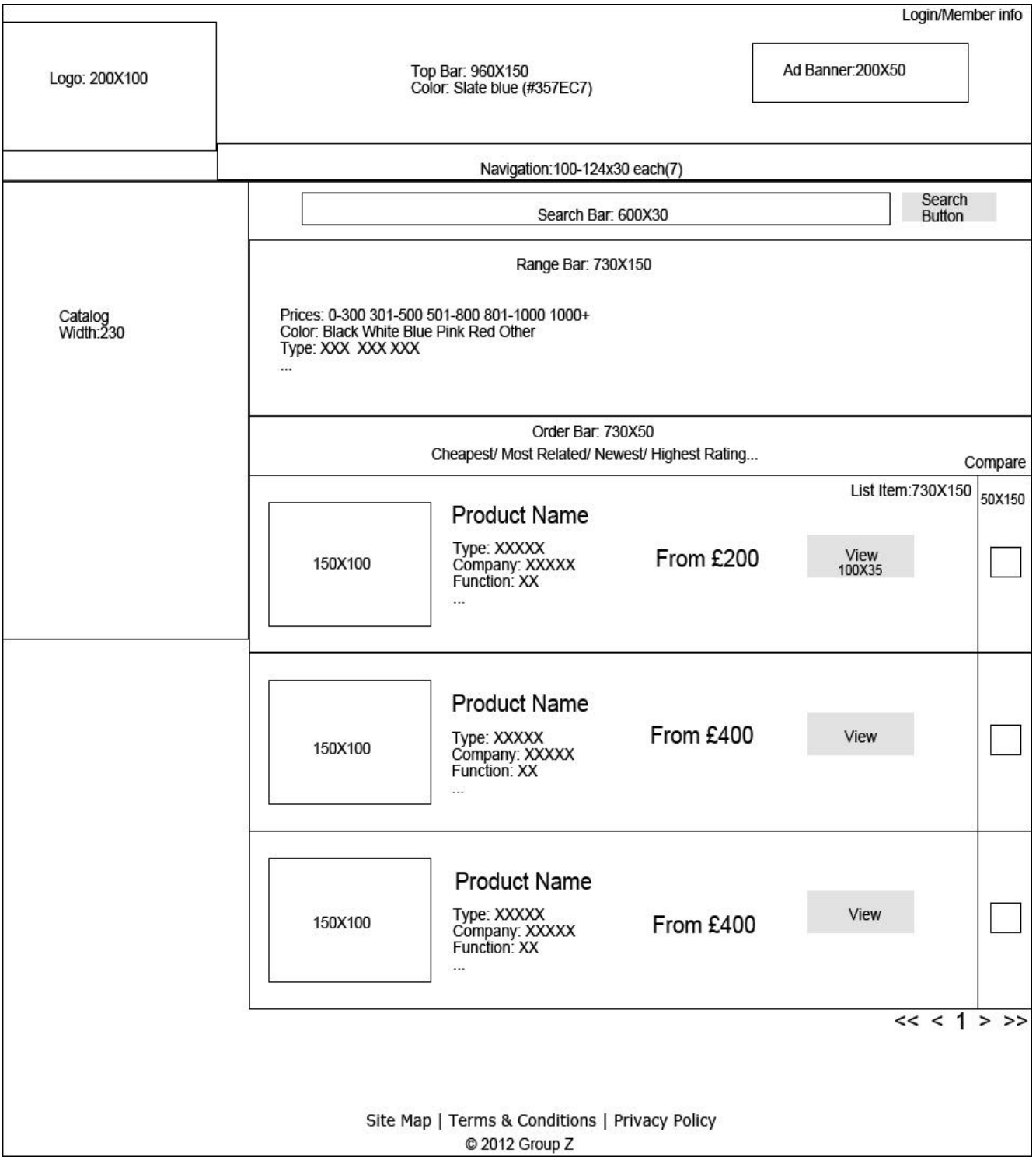
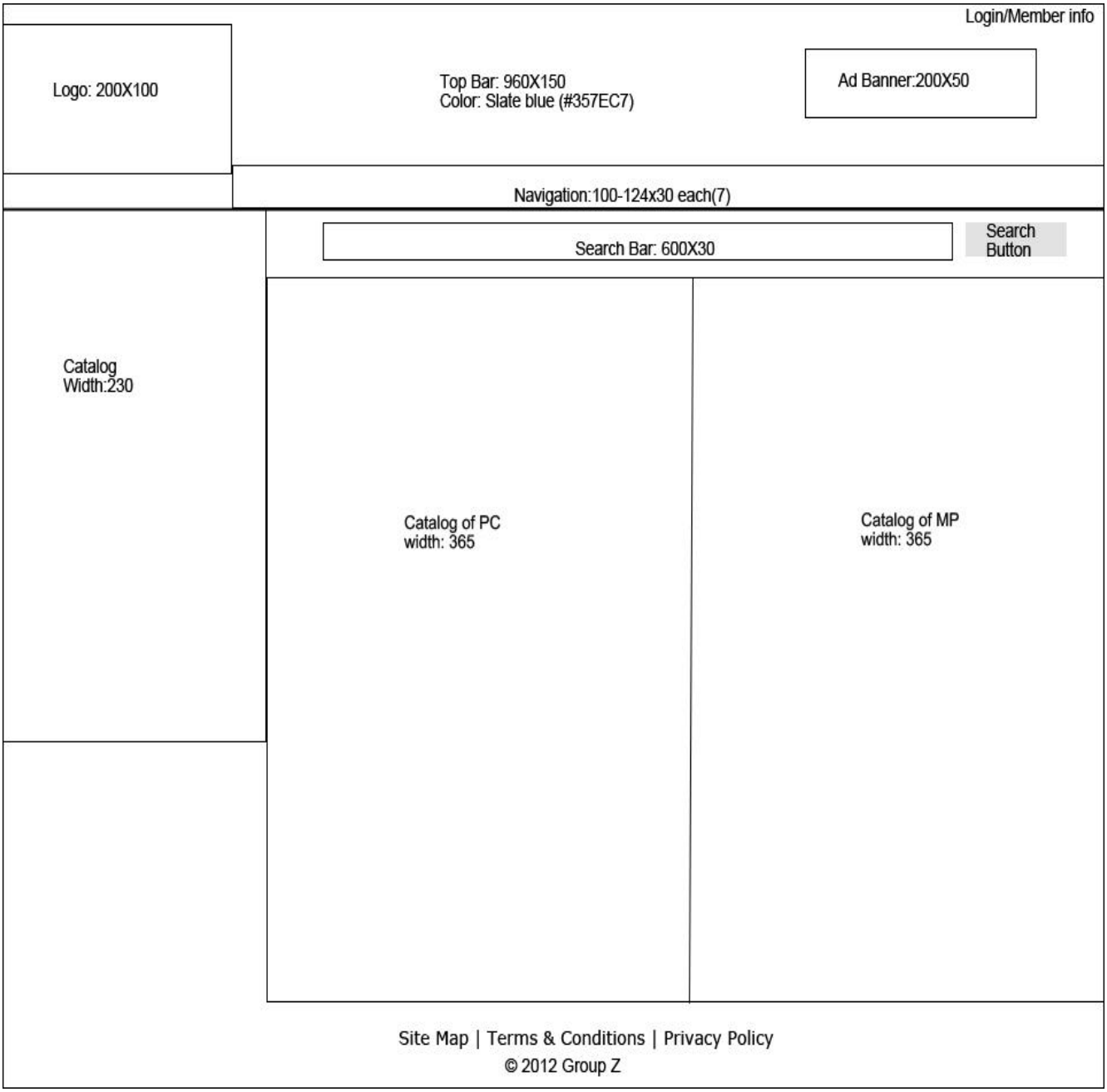
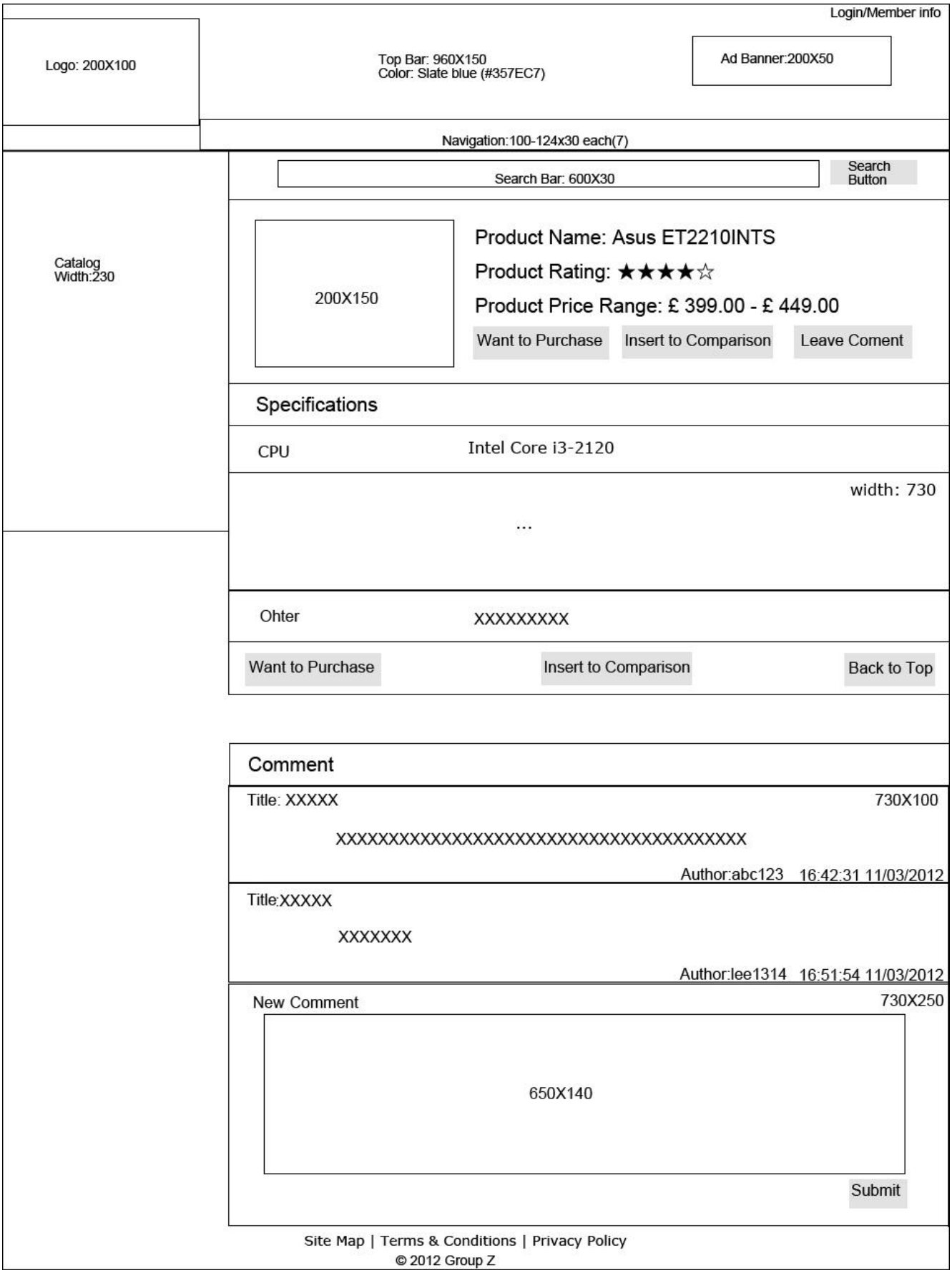
(6) New Release (Ordered by Time), Today's Deal (Ordered by Price), List (Search Result)



(7) Catalog, Site Map



(8) Product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Color: Slate blue (#357EC7)
Ad Banner:200X50
Navigation:100-124x30 each(7)
Catalog
Width:230
Search Bar: 600X30
Search Button
200X150
Product Name: Asus ET2210INTS
Product Rating: ★★★★☆
Product Price Range: £ 399.00 - £ 449.00
Want to Purchase
Insert to Comparison
Leave Coment
Specifications
CPU
Intel Core i3-2120
width: 730
...
Ohter
XXXXXXXXX
Want to Purchase
Insert to Comparison
Back to Top
Comment
Title: XXXXX
730X100
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Author:abc123 16:42:31 11/03/2012
Title:XXXXX
XXXXXXX
Author:lee1314 16:51:54 11/03/2012
New Comment
730X250
650X140
Submit
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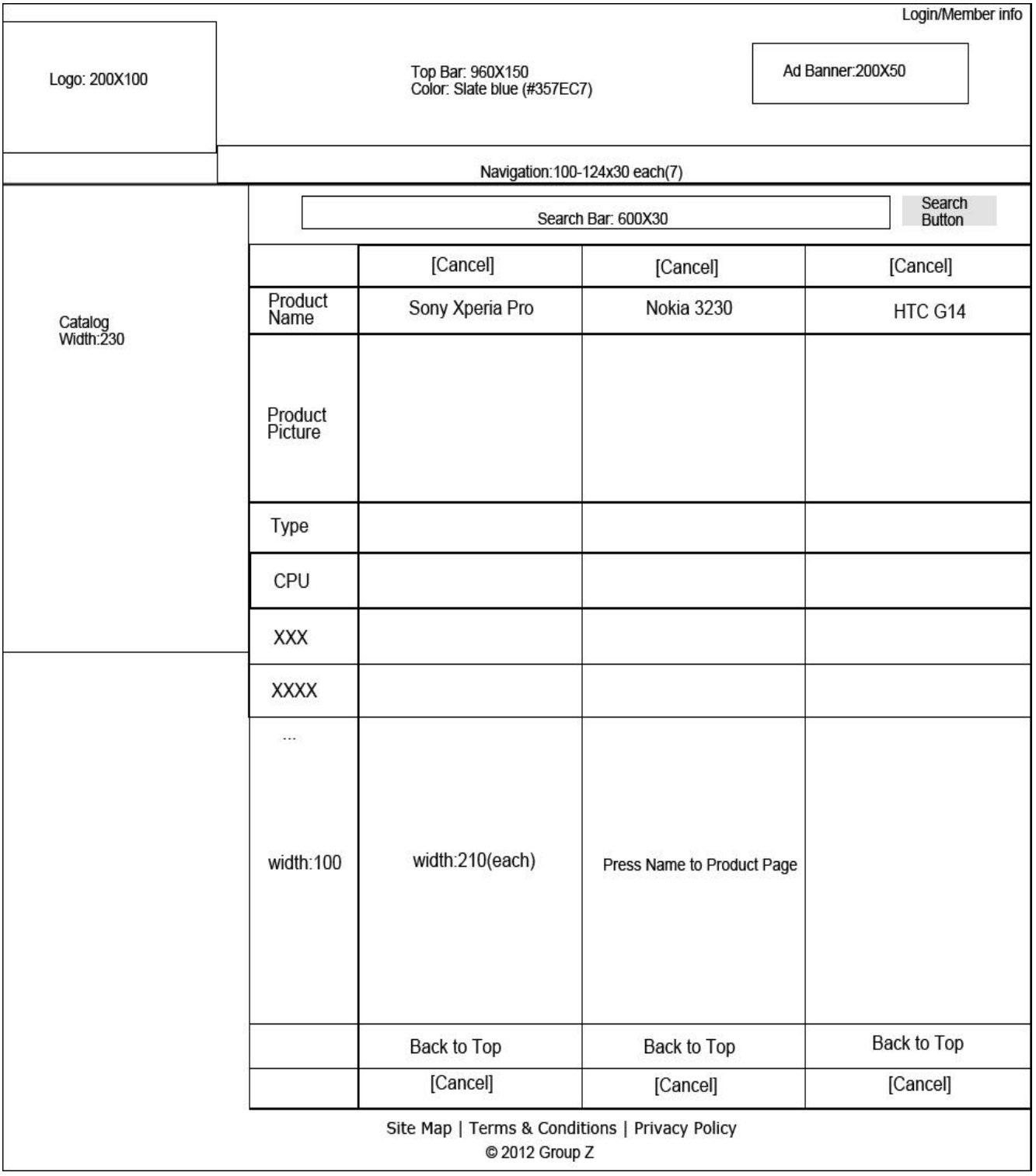
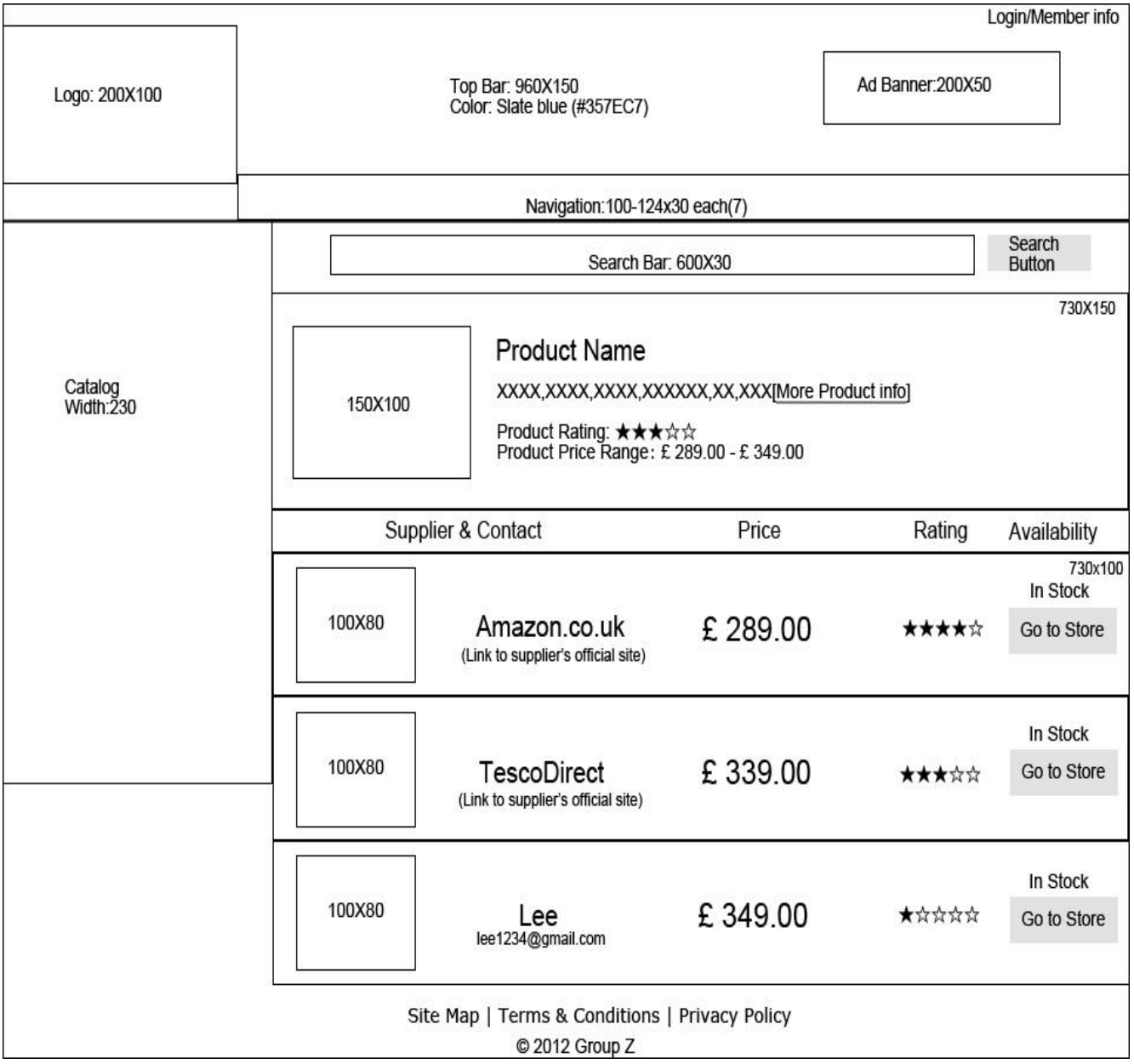
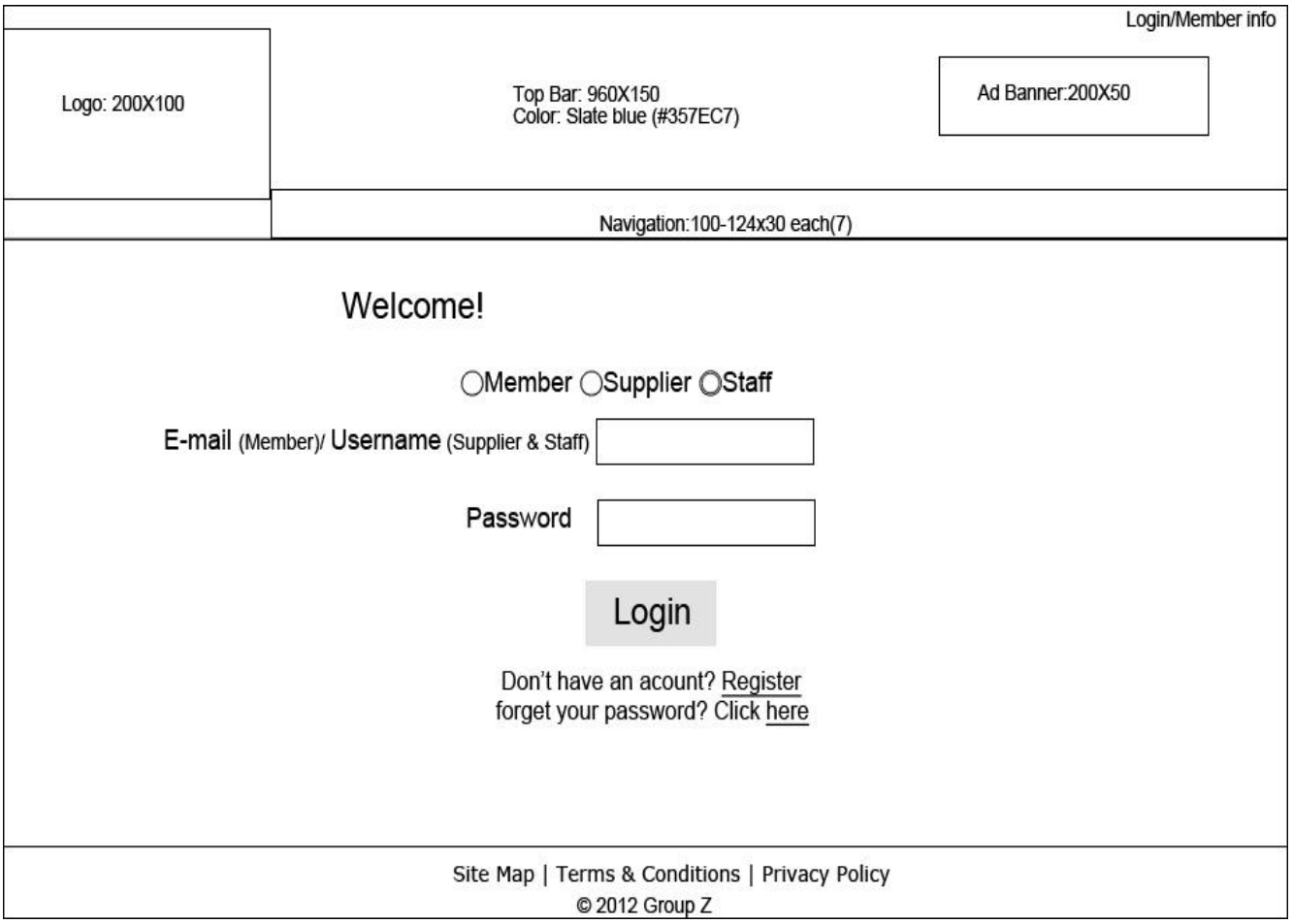
(9) Products Comparison



(10) Prices & Suppliers



(11) Login


Login/Member info
Logo: 200X100
Top Bar: 960X150
Color: Slate blue (#357EC7)
Ad Banner:200X50
Navigation:100-124x30 each(7)
Welcome!
Member Supplier Staff
E-mail (Member)/ Username (Supplier & Staff)
Password
Login
Don't have an acount? Register
forget your password? Click here
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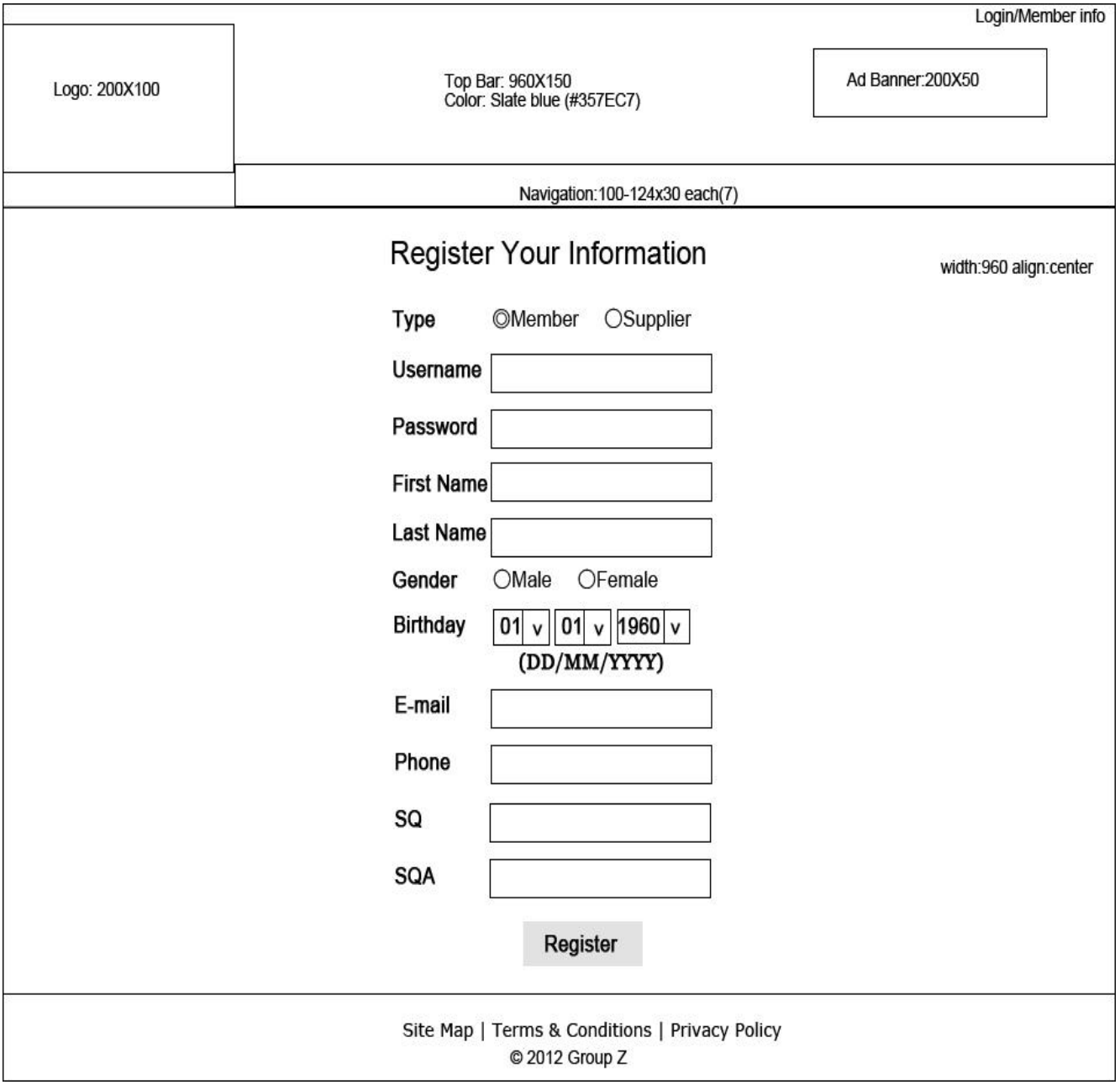
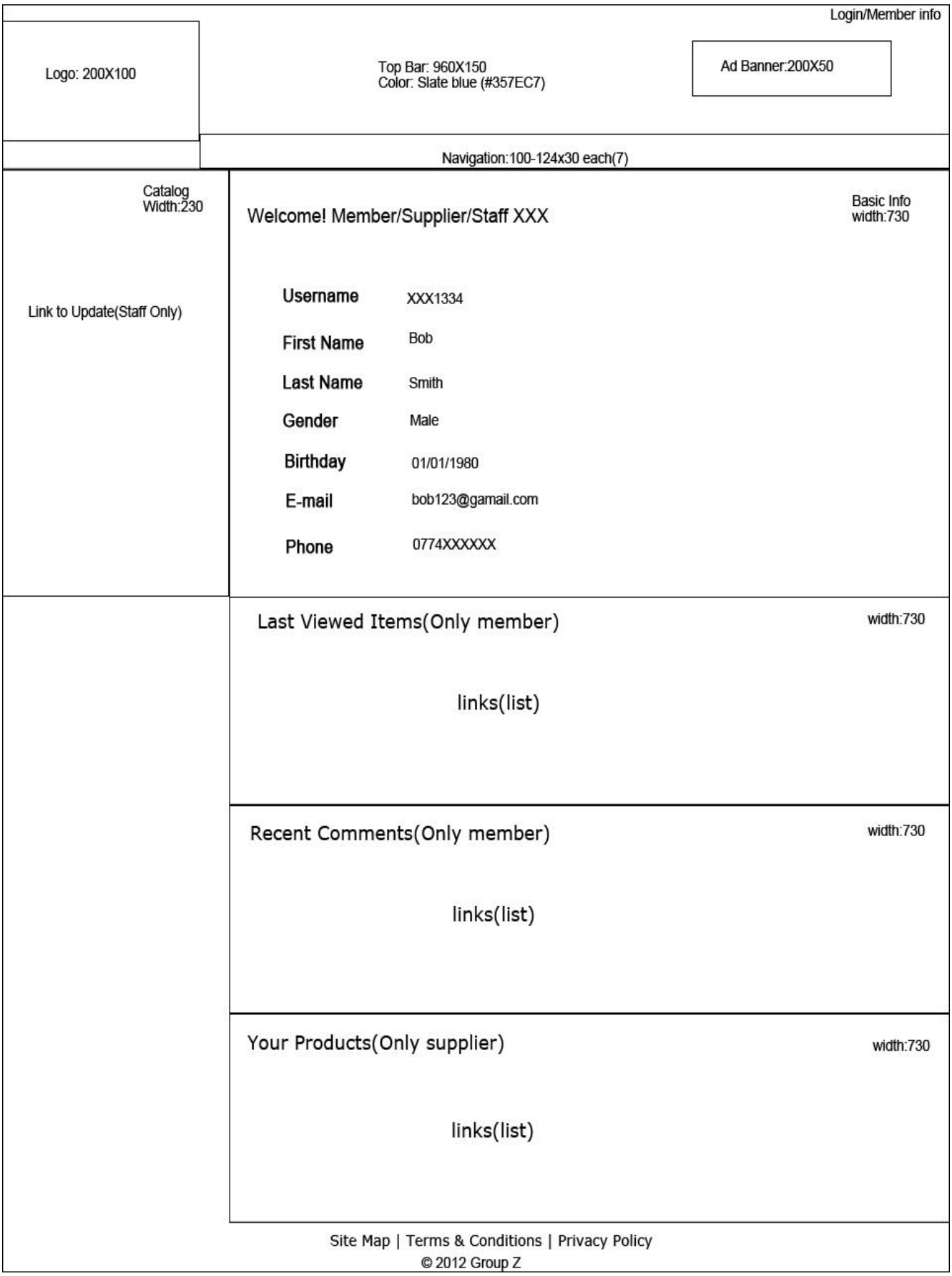
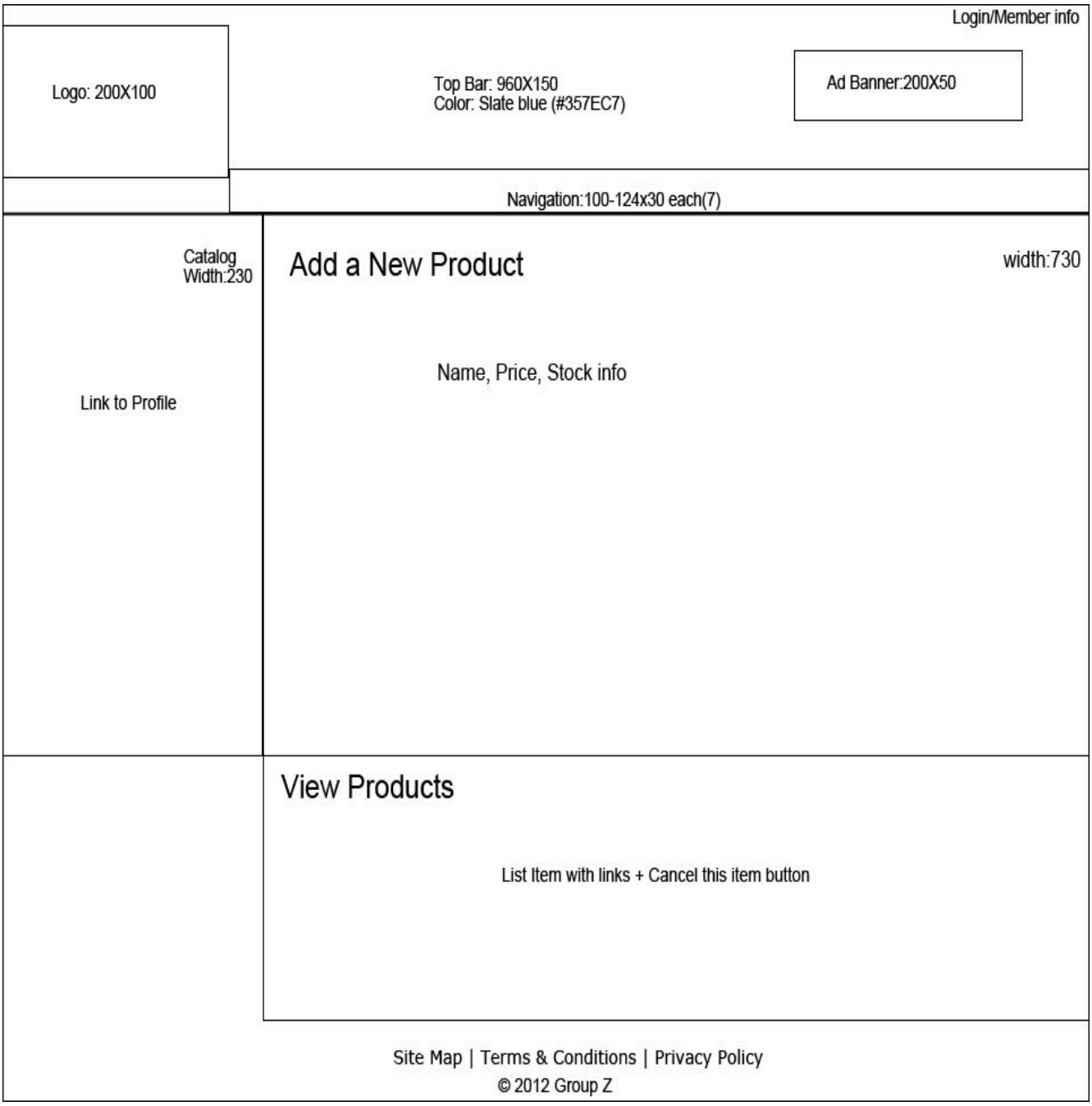
(12) Registration



(13) Member Profile (Only member), Supplier Profile (Only supplier), Staff Profile (Only staff)



(14) Update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Logo: 200X100
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Ad Banner:200X50
Navigation:100-124x30 each(7)
Catalog
Width:230
Add a New Product
width:730
Name, Price, Stock info
Link to Profile
View Products
List Item with links + Cancel this item button
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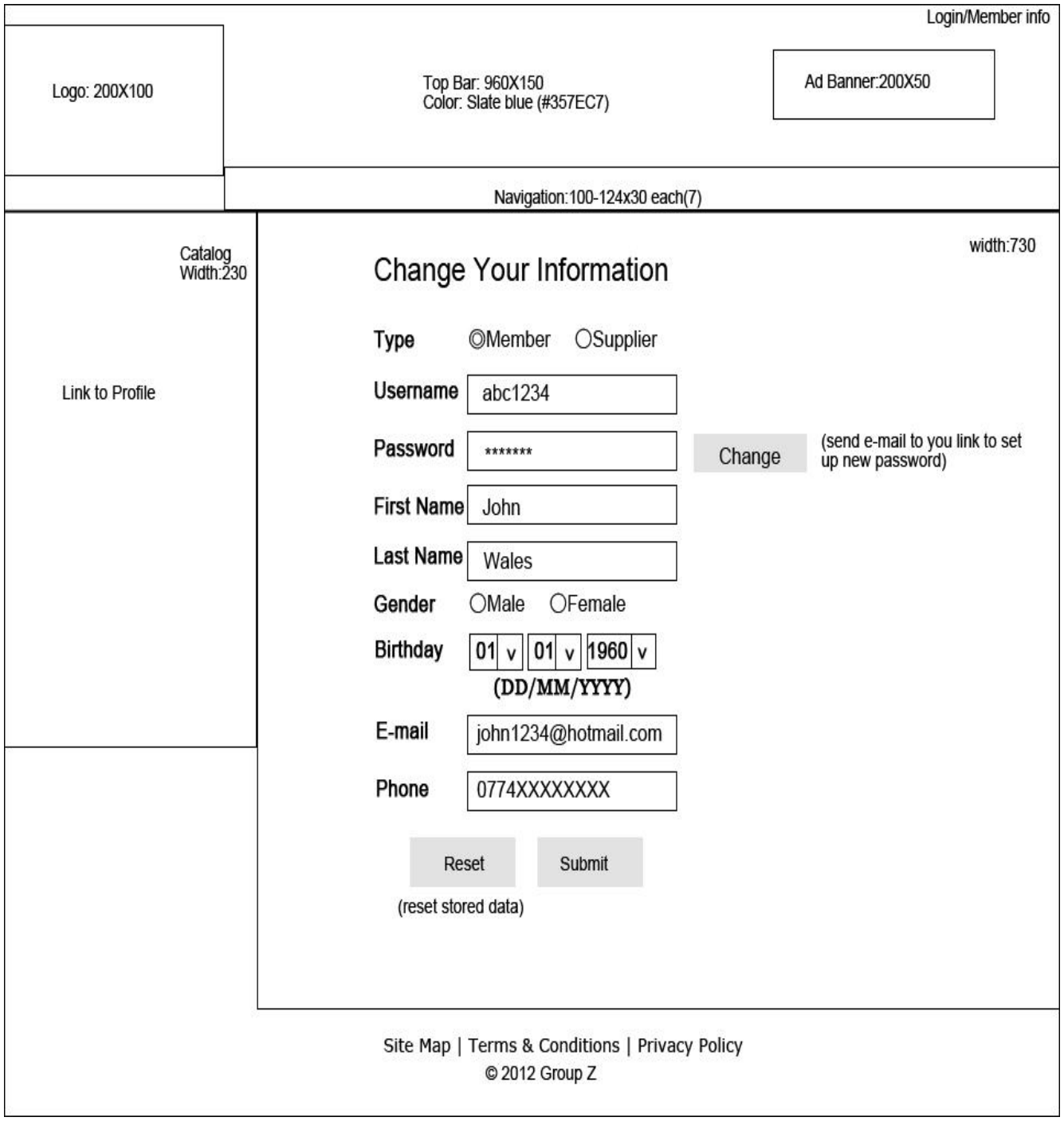
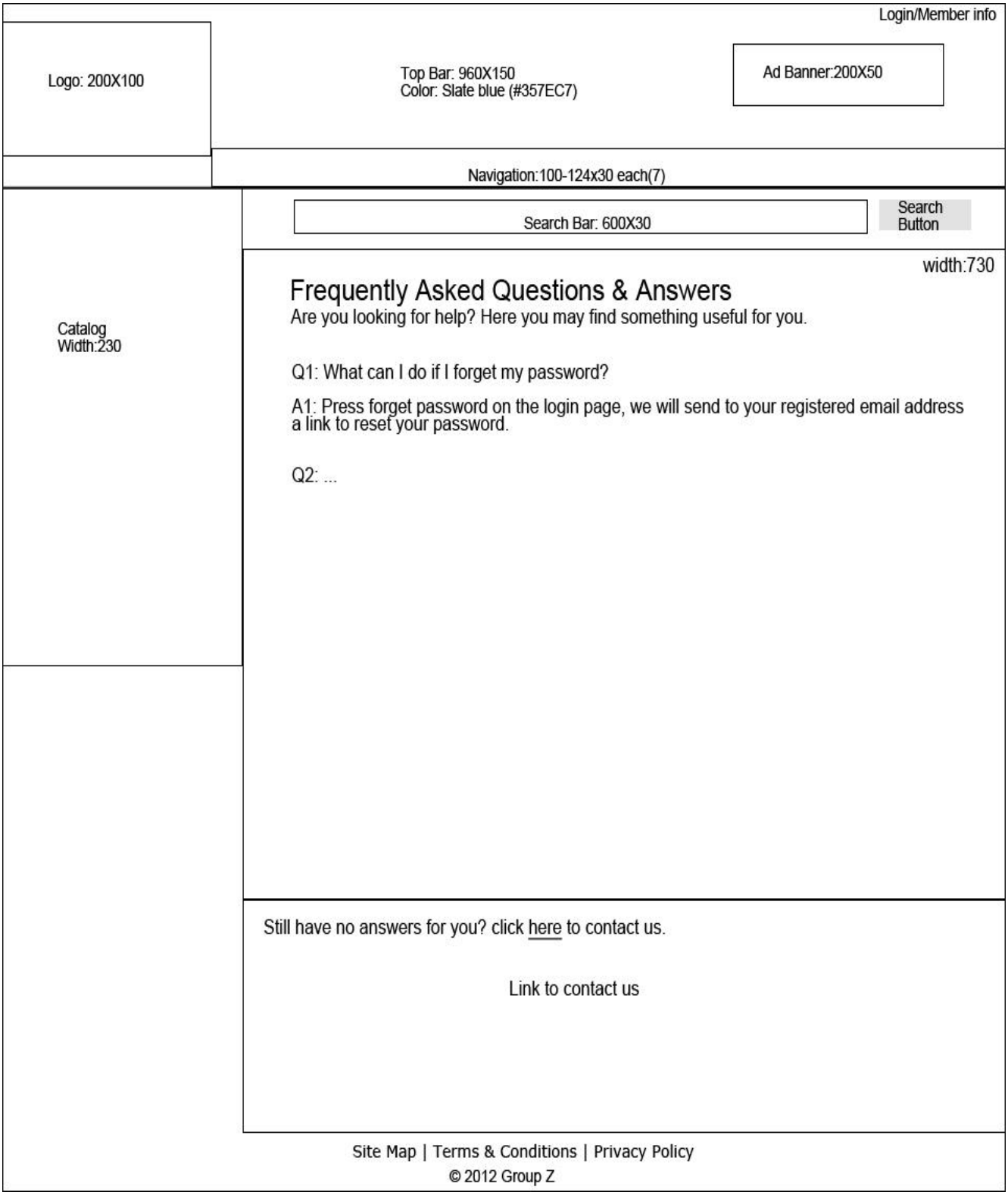
(15) Settings (Only staff with higher authority)



(16) Help (F&A)


Login/Member info
Logo: 200X100
Top Bar: 960X150
Color: Slate blue (#357EC7)
Ad Banner:200X50
Navigation:100-124x30 each(7)
Search Bar: 600X30
Search Button
width:730
Frequently Asked Questions & Answers
Are you looking for help? Here you may find something useful for you.
Catalog
Width:230
Q1: What can I do if I forget my password?
A1: Press forget password on the login page, we will send to your registered email address a link to reset your password.
Q2: ...
Still have no answers for you? click here to contact us.
Link to contact us
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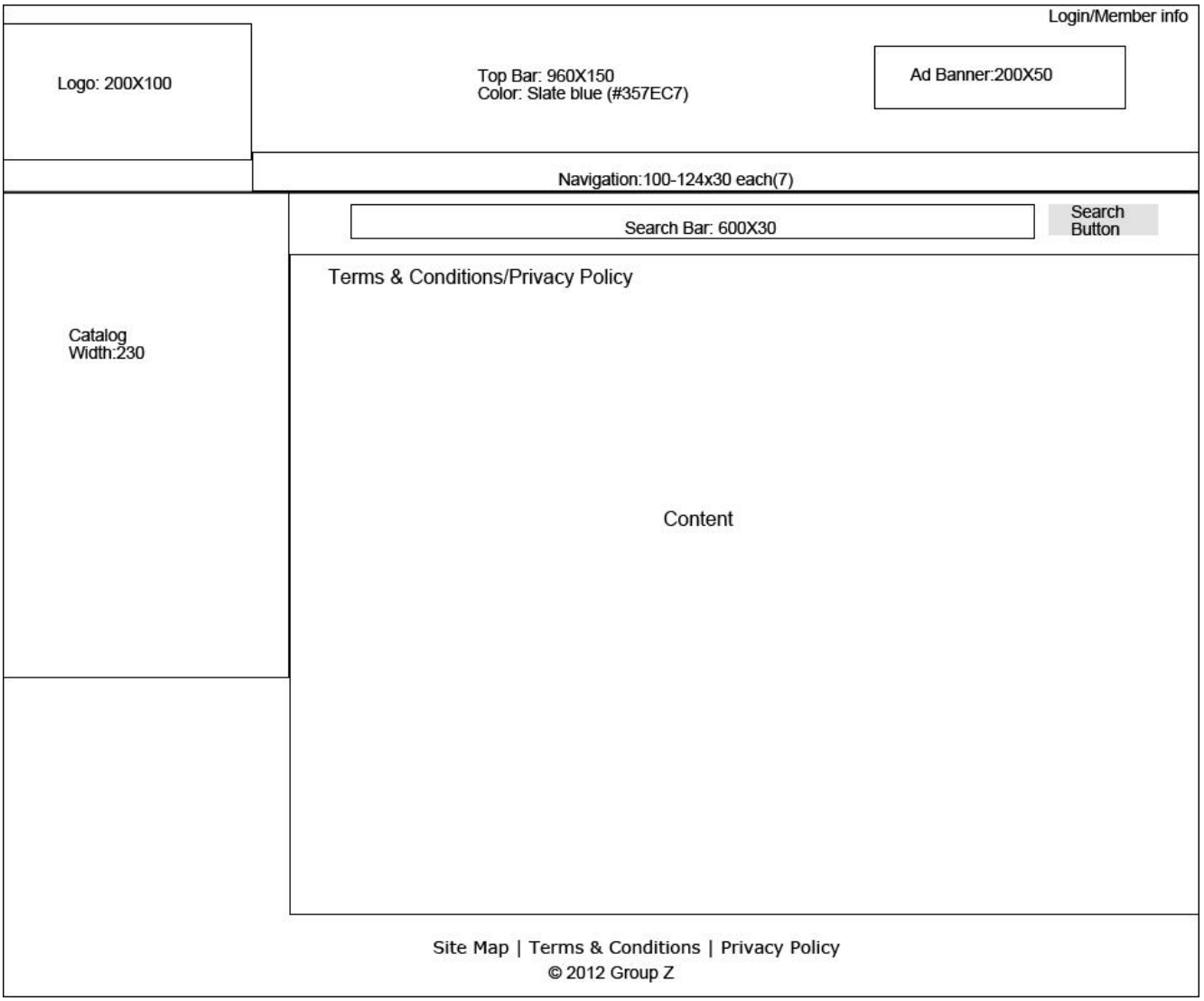
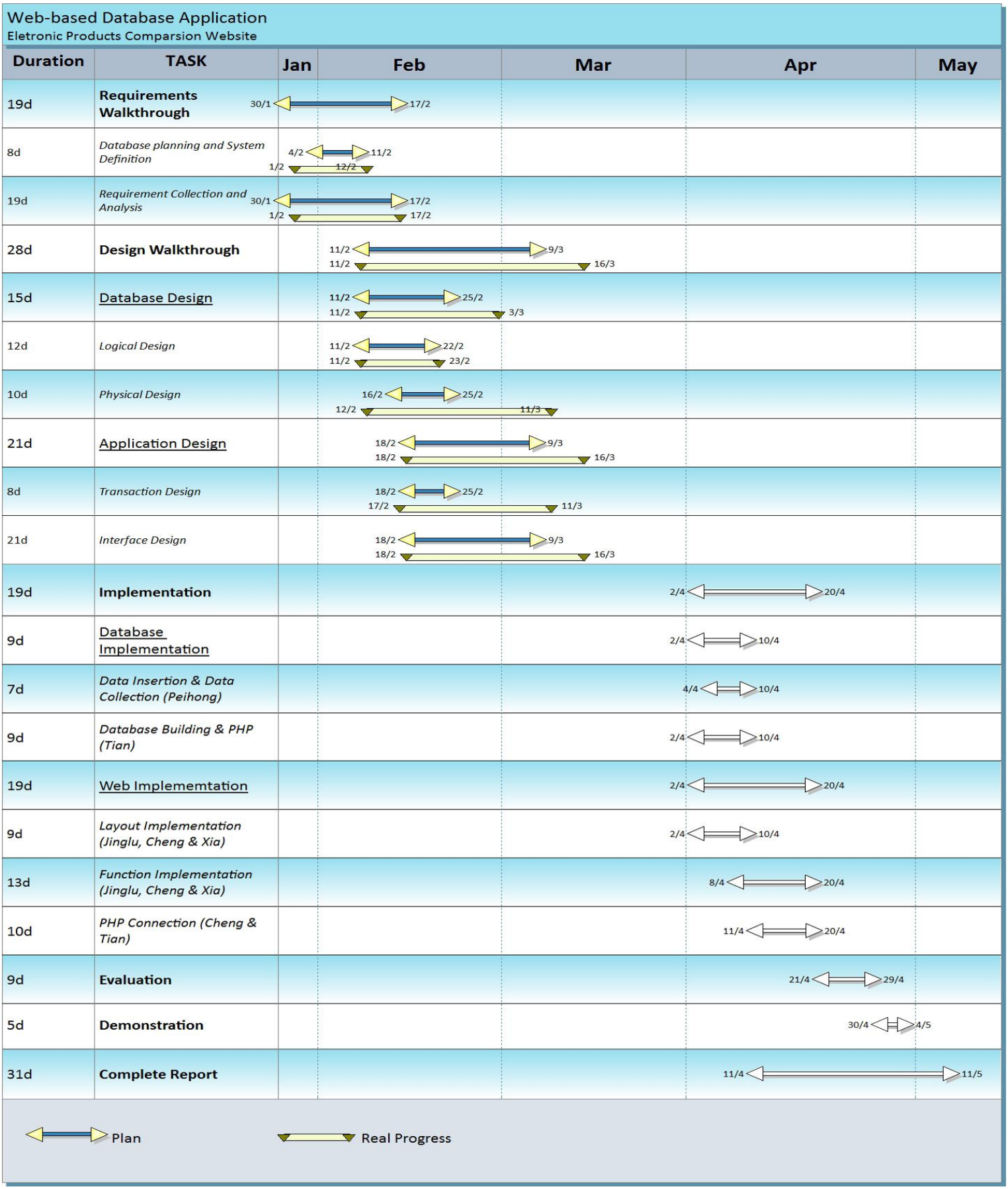
(17) Terms & Conditions, Privacy Policy



Project Gantt Chart